Towards a 2030 Vision on the Future of Universities in Europe

Policy Report

Independent
Expert
Report

Centre for Strategy & Evaluation Services LLP (CSES)
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Towards a 2030 Vision on the Future of Universities in Europe

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Unit RTD.G2
Contact Stijn DELAURE
Email Stijn.DELAURE@ec.europa.eu
RTD-PUBLICATIONS@ec.europa.eu
European Commission
B-1049 Brussels
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Towards a 2030 Vision on the Future of Universities in Europe

Policy Report

Lead Authors:
Mark Whittle, James Rampton (CSES).

Senior Study Experts:
Prof. Dr. Marijk van der Wende
Conor O'Carroll
Peter van der Hijden
Dr Marco Masia

Thematic Experts:
Dr Karen Vandevelde
Prof. Dr Sacha Garben
Gareth O'Neil
Prof. Dr Magnus Klofsten

Supporting authors:
Anna-Maria Krarup, Elias Nacer, Michaela Brady (CSES)
Julia Halej (Coffey)

Centre for
Strategy & Evaluation
Services

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Academic R&I and Research Organisations

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Foreword

The study assignment, **"Towards a 2030 Vision on the Future of Universities in Europe"** was commissioned by the European Commission's Directorate-General for Research and Innovation (DG RTD). It was undertaken by the Centre for Strategy & Evaluation Services LLP (CSES), supported a team of high-level experts composed of academics and ex-academics.

This study is an **independent consultancy study report.** The report required close consultation with key stakeholders as part of a participatory process. The Vision and transformation modules were developed in liaison with key stakeholders. Two stakeholder workshops took place in Brussels, followed by a validation webinar. There was then further consultation with key university networks.

In addition, a Steering Group consisting of different Commission policy units from DG RTD and DG Education and Culture (DG EAC) actively guided and participated in the consultation process through four Steering Group meetings. Its members provided inputs to ensure that existing EU policy and programming initiatives were reflected, given the need to ensure that future EU support builds on current and previous support.

Europe's university landscape comprises more than 5000 universities, and is characterised by its heterogeneity. The Vision provides an enabling, non-prescriptive framework, which recognises the imperative of maintaining the autonomy of universities, and ensuring the principle of academic freedom. It also embodies the values provided in EU primary legislation, which will underpin the Vision's implementation.

Accordingly, the Vision – and the transformation modules that underpin it – need to be flexible enough to accommodate differences between universities. These include the degree of emphasis on their different missions (e.g. educational, teaching, research and innovation, societal), the extent of their existing contribution and future capacity to contribute to excellent science, and their different disciplinary and inter-disciplinary strengths. Reflecting this diversity, the Vision seeks to support universities and to enable them to autonomously determine their own developmental needs and pathways towards the achievement of the 2030 Vision.

Given that the Vision covers a broad range of issues, challenges and opportunities for universities between now and 2030, an effort was made to build a consensus among stakeholders. However, whilst the analysis presented in the report has been closely informed by desk research, stakeholder events and feedback from the university networks, there are divergent viewpoints in some areas. This reflects different viewpoints among different types of universities in Europe and variance in the baseline situation in terms of how strong particular universities are in the research and innovation domain already, and what progress remains.

As such, the study represents the authors' best efforts to establish a degree of consensus on the main priorities for universities in Europe.

In parallel with the publication of the revitalised 2020 ERA Communication (September 2020), this report is designed to provide inspiration for the development of an EU policy framework on the future of universities in the fields of research and innovation. The study therefore provides an important starting point to inform the policy debate on a possible follow-up Communication on the Future of Universities in Europe to 2030 in 2021. This could set out in greater detail how Europe might best support and further enable universities' ongoing transformations, building on the section of the new ERA Communication which addresses this topic.

The study team would like to thank all stakeholders for their active participation and engagement in the debate.

Mark Whittle, CSES, Team leader. 28th September, 2020.

List of acronyms and glossary

List of acronyms and glossary	Full name/ and or description
AI	Artificial Intelligence
Bologna Declaration	A key intergovernmental commitment to reform in higher education. Drafted in 1999.
BFUG	Bologna Follow-Up Group
The Charter	The European Charter for Researchers and Code of Conduct for their Recruitment
CSOs	Civil Society Organisations
DMPs	Data Management Plans (relevant in Open Science / Open Access)
EEA	European Education Area
EEHA	European Higher Education Area, comprised of 48 countries
EGTC	European Grouping for Territorial Cooperation
EIT	European Institute of Innovation
EIT KICs	European Institute of Innovation and Technology's Knowledge and Innovation Communities
EOSC	European Open Science Cloud
ERA	European Research Area
ERAC	European Research Area and Innovation Committee
ERA Partnership	Partnership comprised of Member States, countries participating in the DG RTD Framework Programmes, the European Commission and stakeholder organisations.
ERC	European Research Council
ERIC	European Research Infrastructure Consortium
ESFRI	European Strategy Forum for Research Infrastructures
ESIFs	European Structural and Investment Funds
EUCFR	European Union Charter of Fundamental Rights
EUI	European Universities Initiative (funded under Erasmus+)
European Social Model	A view of the role of universities, higher education, research and innovation.
FAIR data	Findable, Accessible, Interoperable and Reusable data
Fifth Freedom	The free movement of knowledge
FPs	Framework Programmes
HEIs	Higher Education Institutions
HEInnovate	A self-assessment tool for higher education institutions that wish to explore their innovative potential.
ILOs	Industrial Liaison Offices
Industry 4.0	The combination of traditional manufacturing processes with advanced, or "smart" technologies.
IP	Intellectual property
IPR	Intellectual property rights
LERU	League of European Research Universities
Market-Driven Model	A view of the role of universities, higher education, research and innovation.
MSCA	Marie Skłodowska-Curie Actions: Research fellowships within the ERA.
MORE Studies	A series of studies on researcher mobility commissioned by DG RTD. Three have been published to date, with a further MORE IV study underway.
OPs	Operational Programmes (a planning tool used to set out an overall strategy and priorities in European Structural and Investment Funds)
Open Science	The scientific creation of transparent knowledge developed and proliferated through collaborative networks.
R&D	Research and Development
R&D&I	Research and Development and Innovation
R&I	Research and Innovation
RIs	Research Infrastructures
RPOs	Research Performing Organisations
SCs	Societal Challenges
SDGs	The United Nations' Sustainable Development Goals

List of acronyms and glossary	Full name/ and or description
SI	Social Innovation
SMEs	Small and Medium Sized Enterprises
SRLs	Societal Readiness Levels
SSH	Social Sciences and the Humanities academic subjects
STEM	Science, Technology, Engineering and Mathematics academic subjects
TFEU	Treaty on the Functioning of the European Union
TEU	Treaty on European Union
TRLs	Technological Readiness Levels
TTOs	Technology Transfer Offices
TM	Transformation Module
UBC	University Business Cooperation

1. Introduction

The European Commission's Directorate-General for Research and Innovation (DG RTD) commissioned this study, "Towards a 2030 Vision on the Future of Universities in Europe". The study was undertaken by the Centre for Strategy and Evaluation Services (CSES), supported by external senior experts and Coffey consultants. The study was stakeholder-driven and oral and written contributions received from stakeholders, including the university networks and workshop participants, strongly influenced the report's development.

1.1 Study towards a 2030 Vision - introduction

This document sets out the study report to enable universities in Europe[1] to move towards a potential 2030 Vision for the future in the field of research and innovation (R&I).

As central anchors within society, through their R&I and broader missions, universities have a crucial role to play in the identification of the problems, challenges and solutions of society today, and in the future.

The study identifies the needs and priority challenges that many universities will face, and then unbundles R&I needs across specific areas. These needs then translate into potential measures to support universities in their ongoing efforts to make the transitions and transformations necessary to remain relevant to, and strengthen their role in society in future, for instance in knowledge creation and dissemination, delivering talented graduates and researchers to the market, strengthening the mobility and enhancing the career development of researchers, fostering open science practices and open access to data in a more systematic way, and promoting deeper cooperation with other sectors. It is also concerned not only with delivering societally-relevant research, but communicating the relevance of such research to citizens in order to maintain the high level of trust that universities' research mission presently enjoys. The study also considers the extent to which technological developments, such as digitalisation and artificial intelligence (AI) could serve as facilitators of universities' transformations across the different thematic priority areas identified.

In order to implement the Vision, the report sets out thematic and inter-related Transformation Modules (TMs) in the field of research and innovation which have been put forward for consideration as broad areas where transformations are needed. These provide a means to achieve the objectives of the Vision 2030 in a way that allows sufficient flexibility for universities across Europe to implement those actions identified which best address their identified transition needs. The degree of relevance of the different actions identified within the transformation modules to particular universities in Europe, and the most appropriate and effective combination of actions at EU, Member States and university level will vary between universities, and between different countries.

The objective is to develop a responsive and flexible policy framework which supports and empowers universities to facilitate their own ongoing transformation processes and to identify institutional changes based on their identified needs. These may vary widely, reflecting the wide heterogeneity and rich diversity of the university landscape in Europe.

Indeed, the analysis starts from basic principles such as respect for the diversity and autonomy of universities in Europe as a source of strength. Moreover, it recognises the importance of academic freedom, and the integrity of scientific research in Europe. Whilst the 2030 Vision focuses on universities in Europe, it fully recognises universities' unique role as an anchor within communities and innovation ecosystems in tackling societal

[1] Europe in the context of this Vision relates to the EU-27 Member States, EEA and EFTA countries, but as universities are internationalised and engage in transnational cooperation, the concept of Europe could be extended to include EU candidate countries and third countries in close geographic proximity e.g. the UK as the Vision and transformation modules may be of broader interest and applicability.

challenges, their importance as research-performing actors, as well as the need for international cooperation and engagement both with universities and broader sectoral stakeholders in third countries.

The study has fed into the development of the revitalised European Research Area (ERA) Communication published on 30 September 2020. The important role of universities as key societal and economic actors – and how they might contribute to strengthening research and innovation in the renewed ERA context – will be explicitly stressed in the Communication. The Vision will therefore need to be implemented in a way that reflects the broader evolution in the EU policy context, not only the new ERA Communication and the evolution in the six thematic priorities under the ERA, but also the close connection with education to ensure that the necessary synergies and coordination are ensured with the development of a European Education Area (EEA), laid out in a parallel Commission Communication published on 30 September 2020.

1.2 Study objectives and tasks

The overarching purpose of setting out this Vision is to enable universities to strengthen the R&I dimension of their activities, and to ensure that they can meet future needs and challenges despite uncertainty of what these may be. In parallel, there is a need to enable universities to tackle any outstanding obstacles, and for the overall framework conditions in which universities operate to be strengthened and future-proofed to enable them to continue to transform and adapt to meet the educational, societal and economic challenges of the future, including harnessing their catalytic role as knowledge disseminators to society and to industry/business.

In order to achieve the above objectives, the study:

- **Defines a core set of needs, standards and goals for the transformation of universities in the fields of research and innovation**, based on recommendations from previous studies, stakeholder positions, existing tools and mapping of EU-27 national research and innovation systems;
- **Develops a Vision on the future of universities in the field of research and innovation**, with building blocks needed for a European R&I framework, providing directions to future EU policies;
- **Contributes to a political process on the future of universities in Europe relating to the research and innovation dimension (whilst ensuring synergies and coordination in the education field)**, by recommending possible actions that could lead to the transformation of universities.

The key study tasks and dates that stakeholder consultations took place are:

- Desk research and initial consultations leading to the production of an **Analytical Report**;
- **First Workshop (13-14 February, 2020)** with 35 stakeholders and experts to initiate the development of the 2030 Vision, using the evidence gathered through desk research and transformational modules suggested in the Analytical Report;
- The development of a **Policy Brief** based on the outcome of the First Workshop, setting out a revised proposed 2030 Vision, laying out the priorities and needs for the transformation of universities, and suggesting possible actions and instruments;
- **Second Workshop (4 March, 2020)** with 65 participants consisting of umbrella stakeholder organisations and experts to reflect on the 2030 Vision, discuss the ideas and questions put forward in the Draft Policy Brief and to introduce implementation aspects to the vision. Examples of success stories will be requested from participants relevant to the various transformation modules to showcase what steps universities

in Europe could take to strengthen their performance in particular areas;

- **Policy Report** laying out the 2030 Vision, cost-benefit analysis of possible instruments, best practices, and recommended policy actions and instruments;
- **Validation Seminar (April 21st, 2020)**: The draft policy report was discussed at a validation session held by webinar due to COVID-19. The Commission's Steering Group, senior experts from the study team, and selected invitees from university networks took part. Different aspects of the transformation modules, policy actions and policy instruments were discussed to validate and ensure stakeholder buy-in;
- **Stakeholder consultations by email**: in the period after the validation seminar, a second and third version of the policy report were circulated to participant stakeholders and further revisions were made.
- **Final report and cost-benefit assessment (CBA)**: the report contains the final version of the policy report. It also contains a standalone CBA, which could be used in future as the basis for taking forward a prioritised list of actions outlined in the Vision for 2030, in the transformation modules and recommendations.

1.3 Securing the engagement of universities in Europe

The development and implementation of a strategic vision for the future of universities in Europe, and of detailed operational aspects to underpin the vision, will only be possible through a participatory approach, involving the active engagement of universities and their representative organisations, including the crucial role played by the university networks.[2]

Therefore, this study places a strong emphasis on securing stakeholder engagement and buy-in. Universities' feedback has been solicited through the organisation of two workshops and a validation seminar.[3] Ahead of these events, key documents were circulated to participants. For the first workshop (attended by 35 stakeholders, including the study team of external experts), an analytical report was prepared and for the second workshop (attended by 70 stakeholders), a policy briefing note was developed.

The purpose of these events was to solicit feedback on the vision and proposed transformation modules (TMs) for research and innovation and to prompt an interactive and iterative process to agree on the identification of problems/challenges and possible solutions to address these, and on common future priorities that demand change and which will affect universities across the whole EU-27. The workshops also helped to identify the expected challenges and opportunities for universities over the coming decade.

Following the workshops, further feedback has been requested from participants through written comments on the policy briefing and the submission of success stories relevant to the different TMs to highlight good practices of different types of interventions (legal measures, funding instruments, soft forms of support, etc.) that universities elsewhere could replicate. The contributions received from universities and their representative associations has supported the carrying out of a thorough evidence-based assessment, supported by an extensive literature review. A summary of those that contributed in writing is provided in Annex 2.

[2] Examples of university umbrella organisations include the EUA, LERU, the Guild, the Coimbra Group, YERUN, ACA and DAAD, which collectively bring together research-focused and science and technology universities across Europe.
[3] The validation seminar was held virtually, due to the unprecedented situation due to the COVID-19 pandemic.

Stakeholder engagement was necessary to strengthen understanding of the extent to which different types of universities have already made the necessary transformations to equip them to meet future challenges, and how far progress in particular priority areas identified (explained in Section 4, which sets out the transformation modules) extends across the whole EU-27, or is confined to particular Member States. Further efforts will be needed to ensure that success stories showcasing good practices are disseminated and, where possible, implemented more widely across the EU (especially in the widening countries). Given the diversity among universities, explained in Section 2, there would need to be adaptation to the national/regional/local context. Therefore, short examples of success cases have been integrated into Section 4 for each TM.

Feedback from key stakeholders has helped to identify possible support measures in R&I needed at EU level, Member State level and at a university level so as to empower universities to make further transformations across different areas, improving governance to be able to cooperate on a transnational basis within the EU and internationally, strengthening human capital, fostering open science and data, and sharing access to research infrastructures, among other priorities.

2. EU policy context, role and future challenges of universities

2.1 The European Research Area (ERA) and interactions with the European Education Area (EEA)

The development of a 2030 Vision will take place in the context of the revitalised **European Research Area (ERA) Communication 2020,** and in the context of the **European Education Area (EEA)** and the **European Higher Education Area (EHEA),** which has close interlinkages with the new ERA policy framework.

The ERA was launched by the European Commission in 2000 in its Communication, "Towards a European Research Area".[4] The idea of developing a common research area was incorporated into the Treaty of Lisbon, which entered into force in December 2009. Article 179(1) of the TFEU stated, "the Union shall have the objective of strengthening its scientific and technological bases by achieving a European research area in which researchers, scientific knowledge and technology circulate freely".[5] Since that time, EU policy and programming measures have been pursuing the goal of completing the ERA. The overall focus is on strengthening joint R&I at EU level, and across the Member States and regions. The ERA's priorities are to improve and harmonise the conditions for R&I in Europe, and to foster a prosperous European research environment.

The ERA should also be seen in the context of the **Innovation Union Flagship Initiative**, a key objective of the Europe 2020 Strategy. The European ERA Roadmap 2015-2020 is designed to facilitate and reinforce the efforts undertaken by the Member States towards achieving the ERA objectives. The Roadmap was developed in consultation with the European Research Area and Innovation Committee (ERAC), the ERA Related Groups and most of the organisations which make up the ERA Stakeholder Platform. Indeed, these various stakeholder fora are involved in ERA implementation and in contributing to the delivery of the strategic vision set out in the ERA roadmap. Moreover, the ERA process requires close partnership-working between Member States, Associated Countries participating in the RTD FPs, the European Commission and stakeholder organisations, known collectively as the "ERA Partnership".

In 2014, two years after the adoption of its Communication on a Reinforced European Research Area (ERA) Partnership, the Commission reported that EU countries and stakeholders had made good progress in delivering on the six priorities outlined in the ERA, but that further effort would be needed. In 2015, the European Council reaffirmed its commitment to a fully operational ERA and endorsed the ERA Roadmap 2015-2020.[6] This is a living document to guide EU Member States in structuring their implementation of the ERA priorities at national level. It calls on the Member States to implement the ERA roadmap through appropriate measures in ERA national action plans and strategies. The current six priorities in the ERA are:

- **Priority 1 -** More effective national research (and innovation) systems;
- **Priority 2 -** Optimal transnational cooperation and competition, including optimal transnational cooperation and competition and research infrastructures;
- **Priority 3 -** An open labour market for researchers;

[4] European Commission. (2000). *Towards a European Research Area: Science, Technology and Innovation Key Figures 2000*. Brussels: Office for Official Publications of the European Communities. Available at: https://ec.europa.eu/research/pdf/keyfiguresihp.pdf

[5] European Commission. (2012). *Consolidated Version of the Treaty on the Functioning of the European Union.* Brussels: Official Journal of the European Union, 128. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12012E/TXT&from=EN

[6] Council of the European Union. (2015). *Draft Council Conclusions on the European Research Area Roadmap 2015-2020*. Brussels. Available at: http://data.consilium.europa.eu/doc/document/ST-8975-2015-INIT/en/pdf

- **Priority 4 -** Gender equality and gender mainstreaming in research;
- **Priority 5 -** Optimal circulation, access to and transfer of scientific knowledge including knowledge circulation and open access; and
- **Priority 6 -** International cooperation.[7]

These were agreed in 2012 and renewed in 2015 with Member States and a wide range of stakeholders including leading university representative organisations (see Annex III for details). It should be stressed that under the revitalised ERA, there is likely to be a continuing focus on these six areas to ensure continuity, but there will be an evolution in these priorities and additional sub-priorities may also become more important, reflecting key developments in the ERA's evolution. For example, Priority 4 ERA on gender equality and mainstreaming may evolve into a broader focus on inclusiveness (including diversity, widening opportunities to people from wider backgrounds, as well as retaining some focus on gender equality too), digitalisation and the role of AI may have an accentuated role across the ERA priorities in a horizontal manner.

The ERA priorities were principally intended to support and influence Member States' national policies and actions in these priority areas. In turning the 2030 Vision into reality, there is a need for a wider emphasis, which still aims to support and guide Member States but also universities, their partners in R&I and the wider ecosystems in which they operate. This involves setting out the priorities that can guide the choice of EU interventions to facilitate and empower the transformation of universities in R&I.

In the field of education, the EU is developing initiatives to help establish a European Education Area (EEA) amongst its Member States, enabling all young people to benefit from the best education and training, and opportunities to find employment across Europe. This policy envisions that, across the EU, spending time abroad to study and learn should become the norm, school and higher education qualifications should be recognised across the EU, knowing two languages in addition to one's mother tongue should be standard, everyone should be able to access high-quality education, irrespective of their socio-economic background people should have a strong sense of their identity as a European, as well as of Europe's cultural heritage and its diversity.[8] This accords with Art. 165 TFEU.[9]

With a broader geographical scope, the EHEA is an international collaboration comprised of 48 countries, committed to implementing reforms within the higher education sector. A key aim remains the introduction and functioning of a common BA-MA-Doctorate system. The EHEA is based on several key values: institutional autonomy, independent student unions, academic freedom, freedom of expression, and freedom of movement for both students and staff. This process is not EU-specific, but closely intertwined with the EU both institutionally and materially in terms of providing an overarching EU policy framework, and funding support for particular initiatives that facilitate this process.

This continuous work is in pursuit of an overall goal to facilitate student and faculty members' employability and mobility. At the foundation of the EHEA is the Bologna

[7] European Commission. (n.d.) *European Research Area (ERA)*. European Commission. Available at: https://ec.europa.eu/info/research-and-innovation/strategy/era_en
[8] European Commission. (2018). *COM(2018) 268 final, Building a stronger Europe: the role of youth, education and culture policies*. Brussels: European Commission. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018DC0268
[9] European Commission. (2012). *Consolidated Version of the Treaty on the Functioning of the European Union.* Brussels: Official Journal of the European Union, 120. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12012E/TXT&from=EN

Process, launched with the intergovernmental and not legally-binding Bologna Declaration of 1999, which advocates for change and reform in higher education.[10]

The priorities for the EHEA's renewed agenda include improving learning and teaching, opening higher education to disadvantaged learners and traditionally marginalised groups, improving the employability of recent graduates, and internationalising both programmes and financial support. There are clear areas for reform, and broader trends that the EHEA is working to excel in, such as lifelong learning and digital learning/teaching methods. The Bologna Follow-Up Group (BFUG) is tasked with constant monitoring, implementation and coordination of these reforms, and highlighting these key trends to stakeholders in the higher education sector, as well as at the upcoming 2020 Ministerial Conference.[11, 12]

In this context, the Commission is considering the introduction of policy initiatives that will be informed by the current study. They are:

- **Commission Communication** to renew the ERA;
- Possible new **pilot initiative** in the post-2020 programming period to support the transformation of universities in Europe;
- A **transversal part of Horizon Europe** on "Reforming and Enhancing the European Research and Innovation System", which would work towards ERA objectives.

Although each of these policy areas has its own distinctive features and priorities, there are evidently close interlinkages between the ERA, EEA and the EHEA, given the inter-relationship between education, research, and services to society, which includes any type of innovation (the 'knowledge square').[13] Later in the report, the collaborative model of the ecosystem is also considered as regards the interaction between universities in the research and innovation and education spheres, industry, government, and wider societal actors. This is known as the quintuple helix model concept, which extends that of the triple helix model developed by academics at Stanford University.[14] It seeks to strengthen cooperation beyond academia, education and research to include engagement with broader societal actors.[15]

This study, therefore, looks at the role of universities in the broader EU research/science system.

On 24 January 2020, the ERAC Opinion on the Future of the European Research Area (ERA) was published. [16] The report contains a new narrative for the forthcoming revitalised ERA, based around the four principles: Inclusiveness, Relevance, Effectiveness and Visibility. The ERAC Opinion proposes four main priorities for the future of ERA:

- Improve the Framework Conditions for the production, circulation and use of

[10] European Ministers in charge of Higher Education. (1999). *The Bologna Declaration of 19 June 1999*. EHEA and EURASHE. Available at: https://www.eurashe.eu/library/modernising-phe/Bologna_1999_Bologna-Declaration.pdf
[11] Bologna Process. (2009). *Communiqué of the Conference of European Ministers Responsible for Higher Education, Leuven and Louvain-la-Neuve, 28-29 April 2009*. Available at: https://www.eurashe.eu/library/modernising-phe/Bologna_2009_Leuven-Communique.pdf
[12]EHEA. (2018). *Paris Communiqué.* EHEA Paris 2018. EUASHE Available at: http://www.ehea.info/media.ehea.info/file/2018_Paris/77/1/EHEAParis2018_Communique_final_952771.pdf
[13] Unger, M. and Polt, W. (2017). The Knowledge Triangle between Research, Education and Innovation – A Conceptual Discussion. *Foresight and STI Governance*. 11(2). 10-26. DOI: 10.17323/2500-2597.2017.2.10.26.
[14] Smith, H. L., and Leydesdorff, L. (2000). The Triple Helix in the context of global change: dynamics and challenges. Available at: https://leydesdorff.net/th11/th11.pdf
[15] Carayannis, E. G., and Campbell, D. F. J. (2011). Open Innovation Diplomacy and a 21st Century Fractal Research, Education and Innovation (FREIE) Ecosystem: Building on the Quadruple and Quintuple Helix Innovation Concepts and the "Mode 3" Knowledge Production System. *Journal of the Knowledge Economy*. 2(3), 327-372.
[16] ERAC Secretariat. (2020). *ERAC Opinion on the Future of the European Research Area (ERA)*. Brussels. Available at: https://data.consilium.europa.eu/doc/document/ST-1201-2020-INIT/en/pdf

knowledge in Europe, with a special focus on transnational collaboration and European research career issues;

- Ensure broad inclusiveness of R&I in Europe, focussing on a more synchronised co-evolution of R&I systems, facilitating collaborative links and brain circulation.
- R&I driven joint action at European/transnational level with other policy areas, with a special focus on the Sustainable Development Goals (SDGs), including international collaboration; and
- Enhance the relevance and visibility of R&I for society.

The way in which the definition of the TMs has taken into account the ERAC priorities identified for the future ERA are explained in the introduction to these modules in Section 4.1.

The revitalised ERA Communication (September 2020) is expected to address areas which are highly relevant to the achievement of the Vision, such as: ensuring funding arrangements are put in place to achieve the ERA's objectives, and highlighting the role of existing, and potential future newly-created EU legal instruments in fostering closer cooperation in research and innovation between universities to strengthen transnational cooperation and contribute towards enhancing research excellence.

2.2 The university landscape in Europe and role of universities in research and innovation

Given the important role of universities in contributing towards the ERA, context is now provided on the university landscape in Europe, focusing on the research and innovation dimension of universities, but recognising its linkages to education and with the other broader functions that universities fulfil.

There are an estimated 5,000 universities and higher education institutions (HEIs) across Europe.[17] The university landscape in Europe is highly diverse, as universities are characterised by their heterogeneity. It can be characterised according to a number of dimensions, such as the history/foundation of the university, specialisation patterns within the available subjects (and any evidence of interdisciplinarity), funding arrangements and other aspects.[18]

Universities are unique in the diversity of roles performed therein. They provide education; perform different types of research ranging from fundamental to applied (and often, a combination of these); foster innovation ecosystems and knowledge transfer; collaborate with other universities and sectors outside academia at national, European and international level; and provide services to society through outreach activities.

They also serve as creators and disseminators of culture and, as with the ERA, their mission extends to broader societal goals, such as promoting inclusiveness and tackling inequality.

In a LERU paper on the role of universities, the authors note that "the perceptions of Newman and Humboldt have dominated western thinking about the functions of universities".[19] Newman set out the idea of a university in the 1850s and was more concerned with the transmission of knowledge in a teaching context than with its

[17] European Commission. (n.d.). *Erasmus Charter for Higher Education*. Available at: https://ec.europa.eu/programmes/erasmus-plus/sites/erasmusplus2/files/files/resources/he-charter_en.pdf
[18] Daraio, C. et al. (2011). The European university landscape: A micro characterization based on evidence from the Aquameth project. *Research Policy*. 40(1), 148-164. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0048733310002180
[19] Boulton, G., and Lucas, C. (2008). *What are universities for?* LERU. Available at: https://www.leru.org/files/What-are-Universities-for-Full-paper.pdf

generation as research. Humboldt stressed the role of universities in the search for new knowledge through a combination of research and studies.[20]

It should be added that a further 'Napoleonic' tradition has been perceived, in which the function of higher education is to provide a cadre of professionals for the administration of the state, the economy and society.[21]

Differences in higher education models are also influenced by the legal traditions of their respective countries. This has influenced, inter alia, how universities have evolved, and the extent to which – and how – they have adopted reforms.

The historical evolution of different national university systems and of individual institutions is therefore shaped by many factors, including legal traditions. These in turn influence the baseline situation today – the starting position of different universities in different Member States, and the extent to which they need to engage in transformations in particular areas.

Moreover, in the context of Europe's Knowledge Economy, the prominence of the Napoleonic Model of Higher Education can be discerned.[22] This stresses the importance of the professionalisation of higher education policies, strategies and roles, and focuses on strengthening training in skills for researchers and academics to equip them to transfer the knowledge generated in their respective field to other sectors (including through intersectoral mobility).

The potential tensions between the educational remit of universities (i.e. teaching and learning) and the research function remain today, with growing expectations that universities will not only undertake their core pedagogical function and carry out research, but also engage in other activities, such as contributing to the development of culture, cooperating outside academia, citizen engagement in research and science carried out by universities through societal outreach, and the use of research to tackle societal challenges. The debate between Newman and Humboldt remains relevant today, insofar as this influences the conceptualisation of the university and its role.

As centres of teaching and learning, universities in Europe play a key role in developing human resources, thereby fostering a pipeline of talented researchers to carry out research in academic and non-academic contexts (e.g. industrial research, research benefiting the public sector, and challenge-driven research to address societal and global challenges). As such, universities and their researchers at all career stages have an important role to play in the education, research and innovation nexus (the "knowledge triangle") and are closely embedded within regional (and often also national and global) innovation ecosystems.[23]

Universities and researchers therefore play a vital and dynamic role in the economy and society as co-creators of knowledge, transforming new knowledge into economic and public goods, educating citizens, and providing services to society. Co-creation of research outputs and knowledge takes place through cooperation within and between universities,

[20] Vries W.D., Slowey M. (2012). Concluding Reflections. Between Humboldt and Newman. In: Schuetze H.G., Mendiola G.Á., Conrad D. (eds) State and Market in Higher Education Reforms. *Comparative and International Education (A Diversity of Voices)*. 13. Rotterdam: SensePublishers. DOI: https://doi.org/10.1007/978-94-6091-800-1_15

[21] Ben-David, J. (1977). *Centers of Learning: Britain, France, Germany, United States*. New York: McGraw-Hill.

[22] Doh, P., and Bilola, T. (2016). The Prominence of the Napoleonic Model of Higher Education in the Knowledge Economy. *International Scientific Journal of Universities and Leadership*, 3. Available at: https://ul-journal.org/index.php/journal/article/view/33

[23] Reichert, S. (2019). *The Role of Universities in Regional Innovation Ecosystems*. EUA. Available at: https://eua.eu/resources/publications/819:the-role-of-universities-in-regional-innovation-ecosystems.html

and between universities and other actors, such as research-performing organisations, industry/business, and with other societal actors.

Universities dominate the research landscape in many EU countries, although the extent to which they engage in different types of research activities (e.g. basic research, frontier research, applied research etc.) and their research specialisms vary greatly, reflecting differences in the types of universities.[24]

It is difficult to fit into a simple typology, as the role of universities in Europe is both complex and heterogeneous. Nonetheless, a distinction can be made between different types of universities, as illustrated in the table below, which provided selected examples and is non-exhaustive.

Table 2-1 - Examples of different types of universities (non-exhaustive)

Examples of different types of universities	Short description
Technology, research and science-focused universities	Research-intensive universities with strong capabilities in undertaking basic research, often also participation in parallel in mission-driven research with strong societal impact at EU level.
Universities of applied sciences (Fachhochschulen)	Universities of applied science - engaging mainly in educational activities, often with more modest capabilities to engage in fundamental research. For example, a Fachhochschule, or University of Applied Sciences (UAS) is a German tertiary education institution. Each institution specializes in a particular science, such as engineering, technology etc. Some also focus on the applied arts.
Academies of sciences	Academies of sciences are a type of learned society or academy (as special scientific institution) dedicated to sciences that may or may not be state funded. This is a different type of model, which is common in many EU13 countries.
European Universities	The Education Council Conclusions of 22 May 2018 stressed the potential of 'European Universities' to "significantly enhance mobility and foster high quality and excellence in education and research, by strengthening the link between teaching, research and innovation and knowledge transfer, by demonstrating the benefits of multilingual learning, the recognition of qualifications and by developing joint education and research programmes and projects.[25] 41 European Universities have been set up under the European Universities Initiative during its first two years.

There are of course also further distinctions between universities, such as how they are funded e.g. public universities funded by the state and private universities, and differences between specialised and generalist institutions.

Arguably, the capacity of universities with less research capacity needs to be strengthened, although some university networks (e.g. the Guild) gave an alternative view that their research capabilities may not need to be strengthened.[26] Although they could be encouraged to become research-intensive universities, they could alternatively be

[24] Lepori, B., Geuna, A., and Veglio, V. (2017). A Typology of European Universities. Differentiation and Resource Distribution. University of Sussex, SPRU Working Paper Series, Brighton.
[25] Council conclusions on moving towards a vision of a European Education Area (2018/C 195/04) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018XG0607(01)&rid=5
[26] Doh, P., and Bilola, T. (2016). The Prominence of the Napoleonic Model of Higher Education in the Knowledge Economy. *International Scientific Journal of Universities and Leadership*, 3. Available at: https://ul-journal.org/index.php/journal/article/view/33

encouraged to excel in what they do, as they are different types of universities in the first place. Nonetheless, the scope for more universities than is presently the case in Europe to strengthen their research excellence to lift them to the level of leading research universities should be considered over the next decade.

Whereas in some countries, universities are central to carrying out both fundamental and applied research, in other countries a large proportion of research is carried out by public research organisations (e.g. academies and research centres, such as the Centre National de la Recherche Scientifique (CNRS), the Max Planck Society (MPG) of 86 institutes (e.g. the Institute for the Science of Human History) and the Italian Consiglio Nazionale delle Ricerche (CNR)). In other countries, especially the EU-13, academies of sciences play a central role in the research system, alongside universities, with more fragmentation in the research system.

In addition, private sector research is performed in industry by large firms (including multinationals) and by SMEs, sometimes working in conjunction with publicly-funded research organisations and sometimes purely private sector-based. This illustrates the complexity of the landscape and universities' role in the totality of research-performing organisations.

Universities have an important educational and skills enhancement role, in educating critical thinkers capable of analysis and reflection, and in equipping students with the skills they need for the challenges of the 21st century (e.g. digitalisation, entrepreneurship, management and leadership, scientific methods and enquiry, etc.). They also play an important role in developing highly-skilled (post) graduates and researchers and enable them to access employment opportunities, thereby addressing skills shortages. They also provide pathways for researchers to develop their careers at PhD, post-doctoral levels, and tenured positions in academia; as well as to provide a talent pool for businesses seeking to recruit highly-skilled, highly-qualified staff either to carry out research in industry, or to deploy scientific rigour to problem-solving in business.

The majority of universities in Europe are international in their DNA, and are often engaged in transnational research projects to foster scientific and research excellence. Their active participation in transnational research projects is one example of their international engagement. The drive towards excellence has seen research activities and researchers become increasingly internationalised, with increased levels of researcher mobility within an ERA context and, as a result of EU funding opportunities, involving transnational research such as the MSCA.[27] However, outstanding barriers in terms of national regulatory obstacles may impede the free movement of researchers.

International cooperation between universities, other research performing organisations and other societal actors has accelerated, so as to be able to better tackle different, multi-faceted and complex societal challenges and the Sustainable Development Goals (SDGs), many of which have a strong global dimension. Although there has been societal pushback on some aspects of globalisation, scientific and research activities, as well as the development of capacity to address strategic research challenges has increasingly necessitated a more global approach, given the interconnected nature of societal challenges across borders and continents.

There are different views as to the role of universities, and more generally, the purpose of higher education, research and innovation (and their inter-relationship with the economy

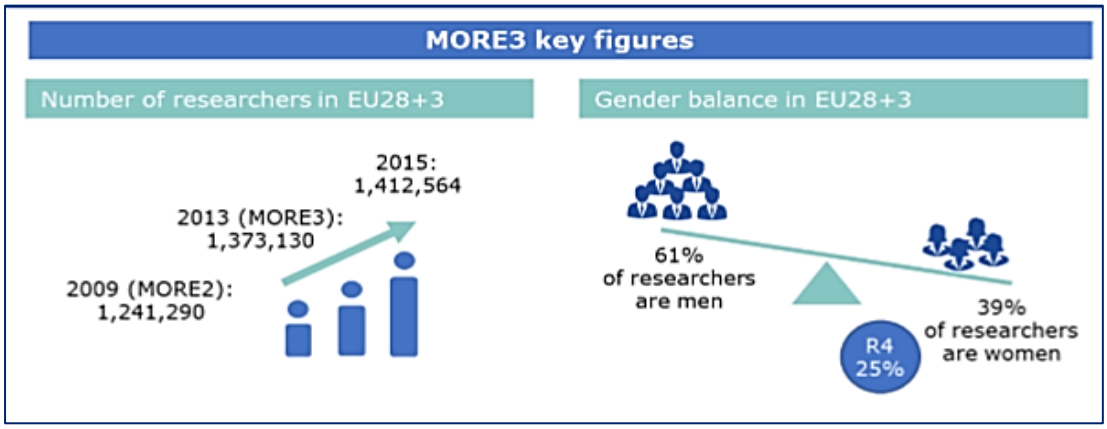
[27] Guthrie, S., Litchten, C., Corbett, J., and Wooding, S. (2017). *International mobility of researchers*. The Royal Society. Available at: https://royalsociety.org/~/media/policy/projects/international-mobility/researcher-mobility-report-review-literature.pdf

and society). A distinction can be made for example between the European Social Model,[28] prevalent in many countries on the European continent and in Scandinavia, and the 'market-driven' model [29] that is more prevalent in other countries, such as the UK. However, the picture is nuanced, with many mixed systems in-between that contain elements of both models along this continuum. This raises a strategic question for universities in Europe discussed at the first stakeholder workshop: "What kind of university for what kind of society?"[30]

These variations in the interpretation of the role of universities impact the context in which the Vision will be implemented. In addition, perceptions of the core tasks of universities, funding arrangements, the degree of autonomy, the extent of collaboration with industry, and with other societal actors etc. vary. Universities operate in a complex paradigm, reflecting differences in national higher education systems and in the evolution of the university system in different countries. A challenge is in ensuring that the future Vision reflects the diversity of universities across Europe, as well as in the national-specific operating environment. The overarching EU policy framework has encouraged certain aspects of the social model and certain aspects of the market model.

The European landscape of researchers should also be mentioned. In terms of its scale, see below for an overview taken from the 2017 MORE 3 study (the MORE 4 study will be carried out in 2019-2021) of the numbers of researchers working within the university sector and private sector environment combined. **Disaggregated data is being sought for the universities sector.**

Figure 2-1 - MORE 3 study – key figures on researchers in Europe



Source: MORE 3 study for Commission's DG RTD by IDEA, Technopolis and WIFO

2.3 Future challenges for universities in Europe

This assignment is concerned with unbundling R&I into priority areas for universities. It outlines a number of "transformation modules" (TMs) that provide different available options to help guide the and empower universities in their own autonomous transformation efforts. These modules need to respond to the challenges facing universities in Europe by empowering universities to manage the continuous process of adaptation which characterises the university sector. In order to identify measures and

[28] Jepsen, M., and Pascual, A. S. (2005). The European Social Model: an exercise in deconstruction. *Journal of European Social Policy*. 15(3), 231-245. Available at: https://pdfs.semanticscholar.org/61a4/fa676a561f2d7784a60b10200b491de78c4c.pdf

[29] Buchbinder, H. (1993). The Market Oriented University and the Changing Role of Knowledge. *Higher Education*, 26(3), 331-347.

[30] Olsen, J. P. (2005). *The institutional dynamics of the (European) University*. Centre for European Studies, University of Oslo. Available at: https://www.sv.uio.no/arena/english/research/publications/arena-working-papers/2001-2010/2005/wp05_15.pdf

actions within transformation modules, it is first necessary to identify strategic developments, trends and potential changes both within and outside the university environment – at national, regional and local levels. These will impact the overall landscape and influence paradigm shifts.

A piece of work by high-level experts directed to the Commission considered the long-term transformations needed in research, innovation and higher education over a longer period of time to 2050, including the role of universities in the future.[31] The report identified a number of challenges and opportunities in Europe where research and innovation undertaken by universities could play a major role, such as: globalisation, demographic changes and technological advances. The report also highlights the importance of the 'knowledge triangle' as an engine for creating, sharing, using and transforming knowledge for the benefit of society. The report notes Europe is strong, but its competitive position is declining in terms of the share of innovative ideas and IPR, compared with major global competitors, such as the US, China and other Asian countries. This is also reflected in Europe's track record in winning major prizes for scientific breakthroughs. Even if the ERC has made a positive difference, for example, in increasing Europe's share in the top 1% of citations globally, most Nobel Prizes for Sciences are awarded to scientists outside Europe.[32]

Further examples of shifts already underway include digitalisation and digital transformation, including the increased role of e-infrastructures. It is also important to note the growing significance of artificial intelligence as a tool for improving the efficiency and effectiveness of research and monitoring research impacts more systematically. Further drivers of change include increased diversity in European society and the corresponding need for greater inclusiveness. Looking ahead, the picture is complex. For example, while globalisation has dominated the narrative for some time, paradoxically, there is also pushback due to growing nationalism in some Member States (and globally), as well as concerns linked to COVID-19 and the risk of health pandemics in future.

Turning to the baseline situation, Europe has a strong knowledge community composed of many high-quality universities, including those with a strong research and innovation (R&I) focus. Whilst there are many excellent universities in Europe, as a whole, their strength in research, education and innovation could be strengthened, and their autonomy reinforced.

As for improving the performance of Europe's universities in the field of research and innovation, Europe has some 30% of the world's top 100 universities.[33, 34, 35] However, around half of these are located in the UK and in Switzerland, both of which are outside the EU-27. Therefore, strategically, there remains a challenge for universities in the EU to ensure that R&I performance is strengthened across universities as a whole to undertake excellent research (lifting the boats), and to move towards the high standards already being set by leading research universities in Europe that score especially well in the

[31] European Commission DG RTD. (2015). *The Knowledge Future: Intelligent policy choices for Europe 2050. Report by an expert group on Foresight on Key Long-term Transformations of European systems: Research, Innovation and Higher Education (KT2050)*. Luxembourg: Publications Office of the European Union. Available at: https://ec.europa.eu/research/foresight/pdf/knowledge_future_2050.pdf

[32] Bourguignon, J-P. (2019). How ERC Changes the European Funding Landscape. *Symposium of the Royal Swedish Academy of Sciences*. [online]. ERC. Available at: https://erc.europa.eu/news/how-erc-changed-european-funding-landscape

[33] Academic Ranking of World Universities, (n.d.) *Academic Ranking of World Universities 2019*. [online] Available at: http://www.shanghairanking.com/ARWU2019.html

[34] Times Higher Education, (n.d.) *World University Rankings 2020*. [online] Available at: https://www.timeshighereducation.com/world-university-rankings/2020/world-ranking#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/stats

[35] QS Top Universities. (2020). *Who Rules? World University Rankings 2020*. [online] Available at: https://www.topuniversities.com/university-rankings/world-university-rankings/2020

rankings. Notwithstanding, there is a need to also diversify the metrics for assessing universities' R&I performance.

For instance, alternative rankings systems that measure universities' contributions towards the sustainable development goals, the Green Deal and open science are examples, as well as U-Multirank, a European ranking system whose basic aim is to provide transparency about the diversity of higher education institutions.[36] [37]

A quantum leap will therefore be needed if universities in Europe are to maintain their globally-leading position in research, or if they have not yet achieved research excellence to make progress towards this objective in a rapidly-changing world. Reform is also necessary if they are to develop the capacity to address the major future challenges. The European university landscape in R&I is highly fragmented, with insufficient coordination, for instance in sharing access to research infrastructures and strengthening the contribution of curiosity-driven research to addressing pressing societal challenges. Furthermore, the problem of brain drain has become more acute and there is a need for more balanced brain circulation.

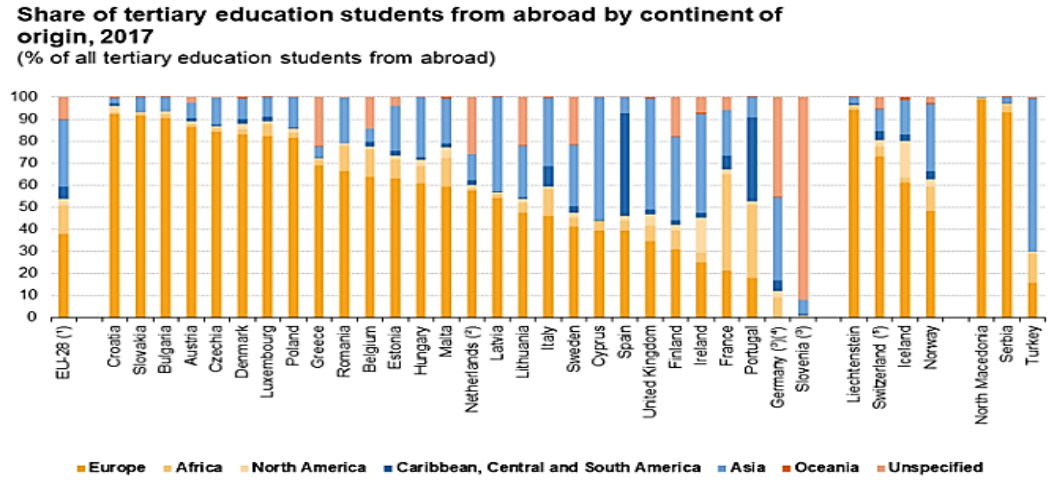
Some universities in the EU are still **insufficiently networked in a structured way with other sectors**. This has arguably resulted in internal inefficiencies within the ERA context, such as the risk of duplication of research efforts. For example, whilst there are institutional structures in place in many universities to facilitate cooperation with industry/business, this is less the case with other sectors.[38] Universities have the potential to make an even greater impact on global and European challenges of a social, economic and environmental nature.

The university sector can achieve this by pushing the barriers of fundamental research and applied science, mobilising innovation ecosystems, supporting the emergence of innovative initiatives and enterprises, and empowering engaged and active research talents and citizens to transform the way we live and work. To make this contribution, universities in Europe need to be supported to work across languages, borders, disciplines and sectors using the human resources (researchers at all career stages) at their campuses effectively to develop the human capacity and knowledge necessary to address multifaceted challenges. Universities will need local, regional, national and European support in various transformation aspects for research and innovation, including the mainstreaming of Open Science and Open Access approaches to make scientific results and datasets more accessible, reinforcing co-operation with non-academic sectors, attracting, retaining and upskilling talent, and citizen and societal engagement.

In some countries, growing globalisation has led to a change in the student and researcher cohort, with an increase in the number of non-EU and also international students and researchers. According to Eurostat, there were 1.71 million students from abroad who were undertaking tertiary level studies across the EU-28 in 2017.[39] More than one-third (37.8%) of students from abroad who were undertaking tertiary studies across the EU in 2017 were from Europe, 30.1% were from Asia and 13.0% were from Africa. This demonstrates that the student and researcher cohort in many universities is becoming increasingly internationalised, as per Figure 2-2 below:

[36] https://www.umultirank.org/
[37] Times Higher Education. (n.d.) *Impact Rankings 2020*. [online] Available at: https://www.timeshighereducation.com/rankings/impact/2020/overall#!/page/0/length/25/name/Auk/sort_by/rank/sort_order/asc/cols/stats
[38] European Commission DG RTD. (2018). *Study on Fostering Industrial Talents in Research at European Level – Final Report.* Luxembourg: Publications Office of the European Union. Available at: https://cdn5.euraxess.org/sites/default/files/policy_library/final_report_intersectoral_mobility.pdf
[39] Eurostat. (2018). *Internationally mobile students in the EU.* Eurostat. Available at: https://ec.europa.eu/eurostat/en/web/products-eurostat-news/-/DDN-20181116-1

Figure 2-2 - Share of tertiary education students from abroad by continent of origin, 2017



Share of tertiary education students from abroad by continent of origin, 2017 (% of all tertiary education students from abroad) Source: Eurostat (educ_uoe_mobs02)

In addition, where regulatory frameworks allow, there is an increasing number of courses taught in other languages to attract a more internationalised student base.[40]

As regards researcher mobility, there is evidently an increasing number of international researchers from outside the EU attracted to work in universities in Europe, and significant numbers of European researchers working intra-EU.[41] There are challenges in obtaining reliable statistics on intra-EU mobile researchers (as these extend beyond the MSCA and ERC grants, where the numbers are known). However, as international mobility is a priority within the previous ERA, some statistics have been produced on 1) doctoral students with a nationality from another EU country and 2) doctoral students from outside EU.[42] The series of MORE studies on Mobility Patterns and Career Paths of EU Researchers (the most recently published MORE III study is from 2017) also provide statistical insights.[43] Evidently, the impact of COVID-19 medium-term could be significant in terms of constraints in attracting international students and researchers.

There is also evidence that significant progress has been made in the development of intra-European mobility and cooperation. The cumulative results from the implementation of the first nine Framework Programmes (the FPs), the COSTS, the ERC and MSCA grants schemes and 30 years of Erasmus, are all very significant in having made a contribution in this regard.

We must also highlight the growing internationalisation and cooperation between the EU and third countries,[44] although there are sometimes cultural barriers to cooperation, and

[40] EUA. (n.d.) *University Autonomy in Europe*. [online] Available at: www.university-autonomy.eu
[41] Inzelt, A. (n.d). *Analysis of Researchers' Mobility in the Context of the European Research Area*. Available at: https://ec.europa.eu/research/evaluations/pdf/archive/fp7-evidence-base/experts_analysis/a.%20inzelt_-_researchers'_mobility.pdf
[42] European Commission DG RTD. (2018). *ERA Monitoring Handbook*. Brussels. Available at: https://ec.europa.eu/info/sites/info/files/research_and_innovation/era/era_progress_report_2018-handbook.pdf
[43] IDEA Consult, WIFO and Technopolis. (2017). *More3 Study: Support data collection and analysis concerning Mobility Patterns and Career Paths of EU Researchers*. Brussels: European Commission. Available at: https://cdn1.euraxess.org/sites/default/files/policy_library/final_report_2.pdf
[44] William Kirby, Marijk Van der Wende (2019). The New Silk Road: implications for higher education in China and the West?, *Cambridge Journal of Regions, Economy and Society*, Volume 12, Issue 1, 20 February 2019, Pages 127–144, https://doi.org/10.1093/cjres/rsy034

in countries, the problem of foreign government interference in international R&I cooperation have been noted.

This problem raises questions about how best to promote openness and co-operation with third countries, whilst also ensuring that knowledge, data security and research integrity are protected against interference by national and foreign governments.

Among the most pressing challenges identified by participants in the first workshop are addressing the SDGs, especially climate change.[45] Whilst technological advances were already mentioned in the 2015 future-oriented study looking to 2050, in common with any foresight study, developments have been very rapid, for instance in the deployment of Artificial Intelligence (AI) and machine learning technologies, where universities and other research performers are playing a significant role. There is consequently a need at EU level to take into account the ethical and human-AI dimensions of AI, which are being considered by regulators globally and have been stressed in recent policy communications and white papers.[46] For universities, there are ongoing ethical implications of using AI technologies that need to be embedded into research ethics policies and practices. In such developments, there is a fundamental and interdisciplinary role for students and researchers from the humanities and social sciences.

Digital transformation is already having a significant impact on universities, one which may accelerate in future in terms of the need for universities to digitalise their activities and ways of operating, for instance, in terms of how they engage and deliver learning to students and lifelong learners [47] , and as regards how they adapt course content to reflect the rapidly-changing dynamics as regards skills needs for jobs in future. For example, an article published as part of the Universities of the Future project notes that Industry 4.0 "has ushered in an impending skills gap. Nearly half of today's jobs will be redefined within a generation."[48]

One must also consider the question of how training could be adapted to equip PhD candidates and post-doctoral researchers and academics with better understanding and insights into the impacts of digitalisation in universities and in responding to likely future changes in skills and labour market needs and the related remuneration of researchers. A 2019 paper by the OECD on the impact of digitalisation on skills needs and the labour market points out that although unemployment due to technological developments may be overstated, "the impact of digital transformation on the nature of work and skills required is real. Many new, productive and rewarding forms of work and jobs are being created as part of the digital transformation, but at the same time, many jobs have disappeared and more are likely to go in the future".[49] A 2018 OECD paper on the future impacts of automation corroborated this noting that "about 14% of jobs in OECD countries are highly automatable. Another 32% of jobs could face substantial change in how they are carried out".[50]

Some stakeholders have argued for a paradigm shift towards ensuring that the universities of the future in Europe move beyond the focus on the knowledge economy understood in

[45] United Nations Development Programme. (n.d.) *Sustainable Development Goals*. [online] Available at: https://www.undp.org/content/undp/en/home/sustainable-development-goals.html
[46] European Commission. (2020). *White Paper: On Artificial Intelligence - A European approach to excellence and trust*. Brussels. Available at: https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf
[47] See Digital Education Action Plan - https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en
[48] Digital transformation and the implications for skills, Steven Worrall, 26 June 2019 http://futureuniversities.com/1693-2/
[49] OECD. (2019). *Preparing for the Changing Nature of Work in the Digital Era*. OECD. Available at: https://www.oecd.org/going-digital/changing-nature-of-work-in-the-digital-era.pdf
[50] OECD. (2018). *Putting faces to the jobs at risk of automation*. Available at: http://www.oecd.org/employment/future-of-work/Automation-policy-brief-2018.pdf

the narrower sense of the Lisbon Strategy (2000-2010) to broadening the effects of research, education and innovation in universities.

This would extend from those working at universities, creating jobs and boosting economic growth, to contributing to ecological, social and economic sustainability. In a knowledge triangle context, universities need to build on their core missions of education, research and 'services to society' in a way that encompasses both existing and new challenges: delivery of talents and knowledge to society, societal engagement, citizen outreach, social innovation, and technological innovation for the benefit of the economy. In order to strengthen delivery of their core missions, universities are involved in a process of extending collaboration patterns to foster interactions with all relevant actors in the context of the evolution towards a quintuple helix model. Overall, universities face many new challenges. Looking ahead to 2030 and beyond, they may need to take into account the increasingly complex interactions between the various disciplines and sectors. Universities may need to redefine the knowledge triangle and instead incorporate more dimensions, creating a "knowledge diamond" with increased interactions, synergies and interconnectivity between research, education, industry, government and society.

In this context, a future challenge is that interdisciplinary collaboration beyond traditional disciplinary structures will be needed. Furthermore, Europe's universities will face challenges arising from the COVID-19 pandemic, and its wider impact on society. At the time of writing, these cannot be stated with any certainty but might include the following:

- General public reduction in investments in research and innovation and in university funding in general due to economic recession, but also a change in the balance between public and private funding;
- Possible shift of research funding towards the life sciences, but at the same time a need to promote STEM-SSH and interdisciplinary co-operation in order to understand and address the broad and multifaceted challenges arising from the pandemic;
- Changing patterns in the geographical physical mobility of researchers resulting from any reduction or re-direction into different disciplines in the availability of research posts (e.g. due to reduced funding). Reduced personal motivation/ability to move may lead to increasing risk of brain drain, as researchers move away from regions or countries hit hardest by recession to places with stronger R&D functions, or where increased investment in R&D is used to drive economic recovery;
- Acceleration in trends towards digitalisation, as researchers, universities and society in general become more familiar with and motivated to use digital technologies; and
- Pressures and societal willingness to change the nature, level or targeting of EU support for R&D.

2.4 Role of the EU in enabling Europe's universities to flourish by 2030

2.4.1 Evolution in the EU policy context on the role of universities since the early 2000s

Since the early 2000s, the important role played by universities in Europe has been stressed in a number of policy communications from the European Commission.[51, 52] The initial focus was on enabling universities to make a full contribution to the Lisbon strategy

[51] European Commission. (2003). *The role of the universities in the Europe of knowledge [COM(2003) 58 final*. Available at: http://www.aic.lv/bolona/Bologna/contrib/EU/role%20of%20universities.pdf
[52] European Commission. (2005). *Mobilising the brainpower of Europe: enabling universities to make their full contribution to the Lisbon Strategy, COM (2005) 152 final.* Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0152:FIN:EN:PDF

by 2010 by harnessing their knowledge and exploiting of the brainpower of academics, researchers and students.

Regarding the higher education dimension, a 2017 Communication on a renewed EU agenda for higher education made clear the importance of strengthening interlinkages between education, research and innovation and other sectors – such as government, industry and wider societal actors (a quintuple helix model).[53] For instance, the Communication stressed the importance of supporting the international mobility of students, staff and researchers as a way for them to develop their experience and skills (through Erasmus+ and Marie Skłodowska-Curie Actions). The Communication also pointed to an innovation gap, as universities "are often not contributing as much as they should to innovation in the wider economy, particularly in their regions. The performance of higher education in innovation varies strongly between EU regions".[54] The role of research-intensive universities and universities of applied science in contributing to innovation and in embedding innovation in regional ecosystems was also stressed.

Stakeholder feedback from the two workshops pointed out a need to develop a broader conceptual framework that goes beyond the Lisbon strategy and examine the role of universities in catalysing excellent knowledge for inclusive societal purposes.

2.4.2 Potential role of the EU in enabling Europe's universities to flourish by 2030

The role of universities in fostering excellent science research and innovation is expected to be addressed partially in the revitalised European Research Area (ERA) Communication.

As mentioned above, universities are expected to be recognised as fulfilling a diverse range of roles, not only in driving progress towards research and scientific excellence, but also in catalysing and disseminating knowledge, and developing pipelines of talents among graduates and researchers.

The EU has a key role to play in setting a supportive research and innovation policy framework that strengthens national policy frameworks and provides synergy with EU policies in other areas. Such a policy framework may require regulatory mechanisms (within the parameters of the EU's competences in this field), support from a range of funding instruments (including but not limited to Horizon Europe, Erasmus+, and European structural and investment funds), as well as other policy instruments that promote cooperation, capacity-building and the spread and uptake of good practice.

At the workshops, stakeholders recognised the important strategic role that the EU can play as an enabler in allowing Europe's universities to flourish. According to feedback received from the university umbrella stakeholder organisations, the EU's role could include: [55]

- **Defending academic freedom and the freedom of the researcher,** within the EU and internationally;
- **Defending standards relating to scientific quality and the validity of scientific methods** against scepticism about the credibility and value of scientific results and research in an era of populism, and increased questioning of university research;

[53] European Commission. (2017). *Commission Communication on a renewed EU agenda for higher education (COM(2017) 247 final)*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017DC0247&from=EN

[54] European Commission. (2017). *Commission Communication on a renewed EU agenda for higher education (COM(2017) 247 final)*. pp 4. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017DC0247&from=EN

[55] Several of these suggestions integrate feedback received from a contribution from the Guild to the development of a Vision for the Universities of the Future – Draft 29 March 2020' (unpublished, submitted to the debate).

- **Securing standards globally, such as research ethics, open science, open data etc.,** and protecting universities from external threats (strengthening cybersecurity to protect data, prevention of IP theft, international non-reciprocation of open science and open data principles in some instances which may demand a more cautious approach.);
- **Removing national and regional (in the case of federal structures) regulatory barriers to the completion of the renewed ERA.** This would help strengthen the internal market and ensure that barriers to the free movement of researchers are eliminated. This would enable universities institutionally, as well as researchers and doctoral students engaged in international mobility to work together and cooperate across borders, ensuring that the heterogeneity and diversity of universities are seen as a source of strength;
- **Promoting the sharing of access to universities' research infrastructures – stakeholders outside academia could benefit from gaining access to state-of-the-art RIs**. This could be managed in a way that benefits both universities and wider research actors in the innovation ecosystem (researchers working in and outside academia);
- **Creating the legal mechanisms for universities to be able to cooperate on research agendas on a cross-border and potentially transnational basis**; and
- **Promoting greater uptake of digitalisation by universities as an agent of transformation**, including their ability to respond to the ongoing COVID-19 pandemic crisis, which demands more sustainable digital solutions to ensure that research and innovation activities, alongside the educational, are able to continue digitally or can be further mainstreamed in a blended format.

Providing support to universities to enable them to strengthen digital skills among academics and researchers to ensure that future (post)graduates and researchers are equipped with appropriate digital skills in formal or in informal education, to enable them to access both academic and non-academic employment opportunities. Research by the OECD has pointed to a mismatch between graduate, and post-doctoral digital skills and the highly-skilled talent needs of employers.[56, 57]

[56] OECD. (2016). *Skills for a Digital World*. Available at: http://www.oecd.org/els/emp/Skills-for-a-Digital-World.pdf
[57] OECD. (2019). *OECD Skills Outlook 2019: Thriving in a Digital World*. Paris: OECD Publishing. Available at: https://www.oecd-ilibrary.org/docserver/df80bc12-en.pdf?expires=1588760309&id=id&accname=guest&checksum=E1DF08F3F6A612BA6F21C7E244901C1C

3. Moving towards a 2030 Vision

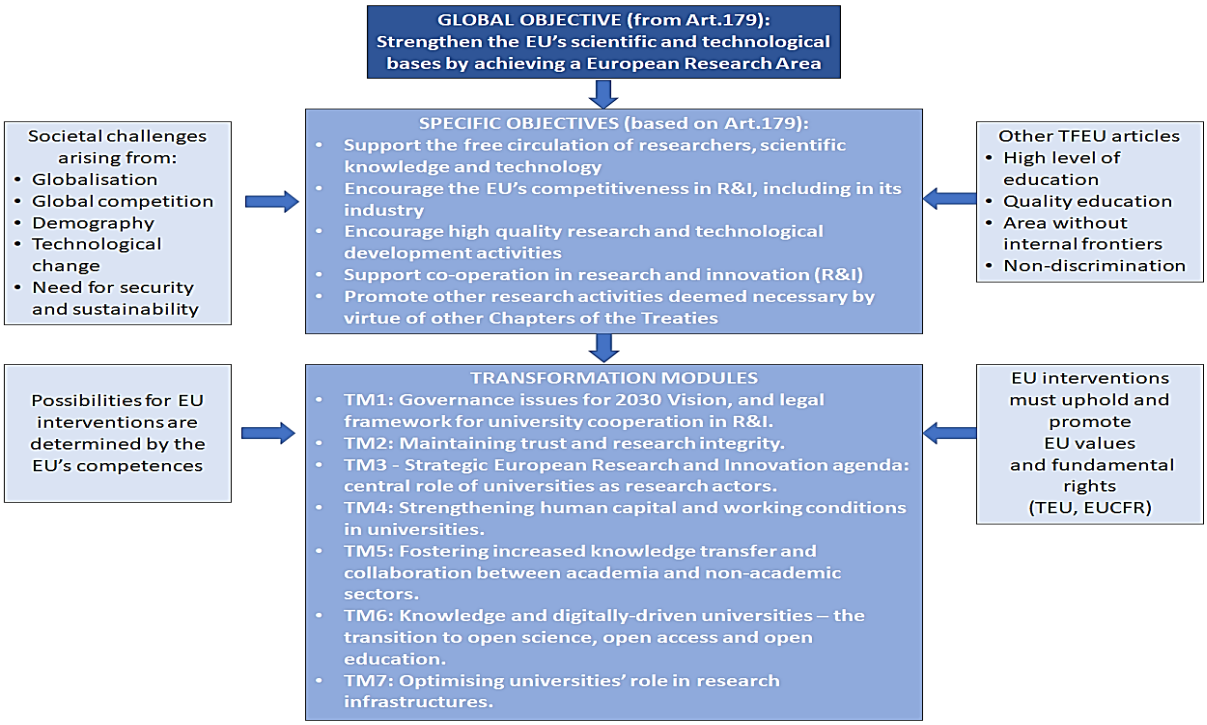
3.1 Introduction

As the revitalised ERA Communication was published on July 22nd, 2020, it is an opportune time to reflect on how the EU policy framework linked to the ERA renewal could best support universities in the ongoing transformations of their R&I activities between now and 2030. This should necessarily encompass the full spectrum of universities' research and innovation activities, whilst taking into account their roles in education and serving society. It should set out the priorities for transformation across the EU, which can then guide the design of policies and programmes at EU level which can, in turn, inform and support national policy and regulatory frameworks.

At the same time, moving towards a 2030 Vision must take account of the diversity of universities within and between the different Member States and the very different contexts in which universities operate. The purpose of the 2030 Vision is therefore to set overall policy and priorities rather than to propose a uniform model that all universities should adopt or that all Member States should comply with. Similarly, there needs to be recognition of the different types of research (output) and a proper respect for their respective merits in general and in relation to EU policy objectives. For example, it is noted that "curiosity-driven" research may be necessary to lay the groundwork for more reactive and/or applied "solutions" in the context of contemporary societal challenges. Linked to this, the 2030 Vision must note the differences and connections between different academic disciplines in terms of their methodology, societal relevance and type of impact and not fail to recognise that all have intrinsic value.

Taking these points into account and drawing on the evidence from the research and consultations undertaken for this study, we present in the figure below the overall framework for the 2030 Vision. The 2030 Vision and the various elements of the framework are described in the sub-sections that follow.

Figure 3-1: Legal basis for the 2030 Vision on universities' role in research and innovation



3.2 Legal basis for the 2030 Vision

By necessity, the 2030 Vision for the future of universities in Europe in the field of research and innovation (R&I) must be grounded in the relevant legal provisions in EU primary law, such as the Treaty on European Union (TEU), the Treaty on the Functioning of the European Union (TFEU) and the European Union Charter of Fundamental Rights (EUCFR). These give an objective and authoritative framework of norms and values within which EU policy on universities' role in R&I should be developed and framed. The 'transformative' or paradigm-shifting idea is that EU policy on R&I not only needs to comply with these primary law values and obligations (which is a legal obligation that can be enforced) but that it needs to be (re)-designed to proactively do justice to these values.

These legal provisions will shape the 2030 Vision in four ways, in that they:

- Give the authority and the mandate for the EU to act in the field of R&I;
- Set the high-level objectives to be pursued;
- Require certain values to be upheld and promoted;
- Specify the rights to be protected and promoted.

Regarding the authority to act, Article 179 of the TFEU mandates the EU to encourage research and technological development activities of high quality and to support cooperative efforts in this field. Here, specific reference is given to permitting researchers to cooperate freely across borders and enabling undertakings to exploit the internal market.[58]

Regarding the objectives to be pursued, Article 179 sets the overall objective of strengthening the EU's scientific and technological bases by achieving a European Research Area. In support of this overall aim, five specific objectives for EU policy in this area can be implied by the text of Article 179 suggests, namely:

- supporting the free circulation of researchers, knowledge and technology
- encouraging the EU's competitiveness in the R&I field, including in non-academic settings;
- encouraging high quality research and technological development;
- supporting co-operation and interdisciplinarity between universities, research centres and undertakings (businesses) in their research and technological development activities; and
- promoting research activities deemed necessary by virtue of other Chapters of the Treaties.

It is also worth noting that Article 165 TFEU also sets objectives in the field of education. This includes an overall objective to contribute to the development of quality education and specific objectives relating to the developing the European dimension in education, promoting co-operation, encouraging mobility of students and teachers (also researchers in teaching roles).

Whilst Article 165 does not constitute the legal basis for the 2030 Vision in the field of research and innovation, the mandate provided for the EU in this field nonetheless forms an important part of the context in which the 2030 Vision will be pursued. Similarly, other TFEU articles are also of relevance, notably Article 9 promoting a high level of education,

[58] European Commission. (2012). *Consolidated Version of the Treaty on the Functioning of the European Union.* Brussels: Official Journal of the European Union, 128. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12012E/TXT&from=EN

Article 18 on non-discrimination on grounds of nationality and Article 26 on the internal market (an area without internal frontiers).[59]

Similarly, to the extent that researchers qualify as "workers", they also fall within the scope of the directly effective right to free movement of EU workers under Article 45 TFEU and the legislative competence for the EU in that area under Article 48 TFEU.[60]

Regarding the **values to be upheld and promoted**, the TFEU states the values that apply to all areas of EU activity. In particular, Article 2 states the EU's founding values as being respect for human dignity, freedom, democracy, equality, the rule of law and respect for human rights, including the rights of persons belonging to minorities. Article 2 also refers to pluralism, non-discrimination, tolerance, justice, solidarity and equality between women and men.[61]

Regarding the **rights to be protected and promoted**, the EUCFR specifies certain rights that specifically relate to research and education: Article 2 states that the arts and scientific research shall be free of constraint and that academic freedom shall be respected, whilst Article 3 recognises the right to education and the freedom to found educational establishments. The EUCFR also upholds the right to freedom of expression and to freedom of movement and residence.[62]

Last, the possibilities for EU interventions are those determined by the EU's competences in the R&I field and in other fields (e.g. internal market) to the extent that they are relevant to R&I.

3.3 Vision and objectives

Drawing on the legal basis for EU action in this field and the objectives therein, in the text box below we propose the following 2030 Vision statement.

Proposed 2030 Vision and objectives

Vision statement

In order to help achieve the European Research Area (and thus strengthen the EU's scientific and technological bases), the EU will support the transformation of universities in Europe and surrounding research systems throughout the EU, so that they are effective generators and transmitters of trusted knowledge and innovation and developers of talent, and so that the university sector, through its research and innovation function, plays its part in addressing key societal challenges.

By 2030, Europe's university sector will:

- be world-leading in research and innovation, grounded in disciplinary excellence and an ability to address complex problems through new interdisciplinary approaches.
- retain a high degree of autonomy and will use this responsibly to provide visible value to and for society through excellence in research and innovation activities;

[59] European Commission. (2012). *Consolidated Version of the Treaty on the Functioning of the European Union.* Brussels: Official Journal of the European Union, 120, 214, 217. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12012E/TXT&from=EN

[60] European Commission. (2012). *Consolidated Version of the Treaty on the Functioning of the European Union.* Brussels: Official Journal of the European Union, 220. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12012E/TXT&from=EN

[61] European Commission. (2012). *Consolidated Version of the Treaty on the Functioning of the European Union.* Brussels: Official Journal of the European Union, 203. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12012E/TXT&from=EN

[62] European Commission. (2012). *Consolidated Version of the Treaty on the Functioning of the European Union.* Brussels: Official Journal of the European Union, 204. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12012E/TXT&from=EN

Proposed 2030 Vision and objectives
• be recognised, trusted and valued by society as leading creators and imparters of knowledge; • develop talented academics and researchers for a rapidly changing Europe and fast evolving workplace; • provide lifelong learning opportunities for academics and researchers along their careers to manage their individual employability opportunities; • be collaborating in the broadest context intensively with non-academic organisations and citizens in their preferred domains; • be open and inclusive and ensure a high degree of integrity in all activities; • ensure excellent, rewarding, equal and inclusive opportunities to develop research careers for citizens of all backgrounds, in particular those from marginalised or vulnerable groups; • have its knowledge, data security, research integrity protected against national and foreign interference; • operate in a level-playing field globally and internally for FAIR, open (but secure and reciprocity-based) exchange of knowledge, data, etc. (EU trade competency); and • maximise the benefits from free movement of knowledge, knowledge workers (researchers) and learners (fifth freedom).
Objectives
EU action in support of this 2030 Vision will have the objectives of: • supporting the free circulation of researchers at all career stages, knowledge and technology • encouraging the EU's competitiveness in the R&I field, including in its non-academic sector, including industry; • encouraging world-leading research across the entire research pipeline, from fundamental/frontier-led to applied research; • supporting co-operation and interconnection between universities, undertakings, research centres and industry (including with individual enterprises) in their research activities; and • promoting research activities deemed necessary by virtue of other Chapters of the Treaties.
Values
Interventions taken by the EU in pursuit of this 2030 Vision will take full account of the potential of universities to uphold and promote European values and fundamental rights, as set out in TEU and EUCFR and as explained in Section 3.4.

The 2030 Vision and its objectives are aligned with key EU policy priorities, notably those set out in Article 179 TFEU, whilst also supporting upholding and promoting the values and rights set out in the TEU, EUCFR and elsewhere. The 2030 Vision and objectives will help to strengthen the R&I function of universities in Europe, which will further improve their contribution to addressing **societal challenges** arising from trends such as globalisation, global competition, demographic change, technological change and the need for sustainability and security. The EU and the Member States will in turn benefit, as whilst universities are already contributing to scientific and research excellence, as well as to addressing societal challenges, the SDGs and other high-level policy goals, supporting universities in strengthening their own research functions will enable them to improve even further.

3.4 Values underpinning the 2030 Vision

The 2030 Vision should provide a framework for universities to exercise autonomy and map out their individual paths towards the achievement of those objectives within the revitalised ERA Communication (2020) that are relevant to universities. The 2030 Vision will be underpinned by a set of core values that reflect the very best of tradition and practices of European academia and that are consistent with broader European values, as set out in the TFEU.

The suggested values that should underpin the 2030 Vision for the future of universities in Europe in the field of research and innovation are as follows:

- academic freedom with responsibility;
- excellence in research, teaching and support for learning;
- ethics, integrity and trust;
- equality and non-discrimination;
- transparency and equity in resource allocation;
- dignity, equity and inclusiveness.

As well as the TFEU, other key documents reference the importance of ensuring research integrity and ethics, academic freedom and institutional autonomy. These include the European Code of Conduct for Research Integrity,[63] the European Charter for Researchers,[64] the Code of Conduct for the Recruitment of Researchers,[65] the Lima Declaration on Academic Freedom and Autonomy of Institutions of Higher Education,[66] the Utrecht Declaration on Academic Freedom[67] and the Magna Charta Universitatum.[68]

The wider legal and international context in place which could also shape the external values in which the 2030 Vision and its modules are being developed includes the importance of promoting sustainable peace and prosperity, incorporating respect for the rule of law and human rights, democratic citizenship, evidence-based policy making and the free circulation of knowledge. These are laid down in the United Nations Sustainable Development Goals (SDGs),[69] Charter of the United Nations,[70] Universal Declaration of Human Rights,[71] European Convention on Human Rights,[72] and the Treaty on the Functioning of the European Union (TFEU).[73]

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[63] ALLEA. (2017). *The European Code of Conduct for Research Integrity: Revised Edition.* Berlin: ALLEA. Available at: https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf

[64] European Commission. (2005). *The European Charter for Researchers.* Available at: https://euraxess.ec.europa.eu/jobs/charter/european-charter

[65] European Commission. (2005). *The Code of Conduct for Recruitment*. Available at: https://euraxess.ec.europa.eu/jobs/charter/code

[66] 68th General Assembly of World University Service. (1998). *The Declaration on Academic Freedom and Autonomy of Institutions of Higher Education*. Available at: http://ace.ucv.ro/pdf/lima.pdf

[67] AHRI. (2016). *Utrecht Declaration on Academic Freedom*. Utrecht. Available at: https://www.cesaer.org/content/7-administration/legal-affairs/values/utrecht-declaration-on-academic-freedom.pdf

[68] University of Bologna.(1986). *Magna Charta Universitatum*. Available at: http://www.magna-charta.org/resources/files/the-magna-charta/english

[69] United Nations. (n.d.). *About the Sustainable Development Goals*. Available at: https://www.un.org/sustainabledevelopment/sustainable-development-goals/

[70] United Nations. (1945). Charter of the United Nations. [online] Available at: https://www.un.org/en/charter-united-nations/

[71] United Nations. (1948) Universal Declaration of Human Rights. [online] Available at: https://www.ohchr.org/EN/UDHR/Documents/UDHR_Translations/eng.pdf

[72] European Court of Human Rights, and Council of Europe. (2010). European Convention on Human Rights. [online] Available at: https://www.echr.coe.int/Documents/Convention_ENG.pdf

[73] European Commission. (2012). *Consolidated Version of the Treaty on the Functioning of the European Union*. Brussels: Official Journal of the European Union. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:12012E/TXT&from=EN

3.5 Overview of problems hindering the pursuit of the objectives

As discussed in Section 2, universities are a key player in research and innovation and as such, contribute along with other research-performing actors to the overall objective of Article 179 (and the specific objectives derived therefrom), as shown above in Figure 3.1.

At the same time, a review of literature and other evidence undertaken for this study has shown that a number of problems risk limiting the contribution of universities to the achievement of the Article 179 and risk limiting the role of universities in upholding and promoting EU values and fundamental rights. These factors are summarised in the table below and described in more detail in Section 4.

Table 3-1: Overview of problems

Problems hindering the pursuit of the objectives outlined in Article 179
Support the free circulation of researchers, scientific knowledge and technology
• Free circulation can be hindered by EU or national legal frameworks. • The uneven level of support and social security aspects to improve the employability of researchers poses a risk of hindering their circulation across different countries, disciplines and sectors. • Where free geographical circulation is successfully achieved, it can risk a "brain drain" away from countries with weaker research sectors towards those with stronger ones. • The culture and governance of universities and the systems of rewarding researchers do not always equally support the practice of Open Science in different Member States. • The circulation of knowledge is hindered the absence of a sufficiently widespread uptake of Open Science practices, for example, the lack of recognition of open access journals. • There is a need for more research data to be FAIR, findable, accessible, interoperable and thus reusable. • There is a risk of interference in the EU's R&I level playing field arising from malign actors and external parties in some third countries, with a particular concern as regards the degree of reciprocity in open access to data sharing from some of the BRICs. • A factor limiting academic freedom (and the free circulation of ideas/knowledge) is that there is considerable pressure for universities to capture third-party private and public funding and insufficient institutional funding for research and innovation[74] that could encourage risk-taking. This problem could be exacerbated if there are funding shortfalls due to COVID-19.
Support the EU's overall competitiveness, including its industrial dimension
• The research base in key emerging technologies (AI, deep tech, etc) and other fields is not sufficiently strong by global standards. • Supportive national policy frameworks are needed to promote synergies between universities and non-academic sector, including industry and the growth of innovation ecosystems for the disciplines where this is relevant. • Current systems of evaluation of academic and research careers do not always recognise and reward efforts to collaborate with industry or time spent on teaching. • Universities do not always have in place the necessary flexible, interactive, modern and compatible organisational and management structures to co-operate with other sectors, including industry. However, caution is needed when implementing governance reforms to ensure that academic freedom is not compromised. • The role of universities and their existing are R&I infrastructures is not always sufficiently exploited and well-recognised in national and EU contexts. • Certain types of large R&I infrastructures, necessary to maintain the EU's competitiveness in

[74] See for instance: (1) https://www.tandfonline.com/doi/abs/10.1080/21568235.2016.1275975 (2) https://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=23947&lang=en and (3) https://omnibus.au.dk/fileadmin/user_upload/Undersoegelse-af-forskningsfrihed-aarhus-universitet-2.pdf

Problems hindering the pursuit of the objectives outlined in Article 179
R&I, are very expensive to build and operate. • Universities face cultural, technical, financial and other barriers in sharing access to research infrastructures between themselves and with non-academic sectors. • There is a need for a level-playing field globally and internally for FAIR, open (but secure and reciprocity-based) exchange of knowledge, data, etc. (EU trade competency). • In many universities, new public management policies have introduced pressures of accountability and performance management, often without granting the level of autonomy needed to meet these expectations.
Encourage high-quality research and technological development activities
• Certain institutional, national, regional and European governance frameworks or funding models may hinder the ability of some universities to perform high quality research. • The brain drain of talent away from certain countries with weaker R&I capacity risks exacerbating the problem at an institutional level that some universities have in retraining top research talents. The concept of brain circulation, as well as the deeper internationalisation of universities in EU13 countries to provide researchers with opportunities to engage in international research projects without being obliged to seek opportunities in other countries, could help to overcome this problem. • Some areas of high-quality research require universities to be part of a wider R&I ecosystem that is supportive to collaboration and FAIR sharing of R&I. • Some research requires very large-scale physical research infrastructure, which is only affordable or efficient to provide at transnational and EU level and where the gains need to be shared across Member States. • A silo approach in funding or management can hinder inter-disciplinary research.
Support co-operation in research and innovation
• The diversity of national frameworks raises challenges for cross-border and transnational co-operation between universities in R&I. • Different models of funding for universities and for R&I may support or hinder universities in co-operating with other universities or with other bodies. • The diversity of national frameworks raises challenges for co-operation between universities in R&I. • Through their R&I activities, universities are important producers of knowledge (i.e. a linear model of knowledge creation). However, different societal stakeholders also produce knowledge and the concept of co-creation is important (e.g. the quintuple helix model involving a dynamic model or knowledge production). • Notwithstanding, knowledge produced by universities in terms of its quality and scale is very different to the knowledge produced by other stakeholders. Therefore, the key is to recognise the complementarity between these different types of knowledge. For instance, Universities excel at low-TRL research, which industries generally do not have the capacity to perform. • It will therefore be important to recognise and foster the particular type of knowledge created by universities, and ensure its complementarity to that produced by other actors.
Promote other research activities deemed necessary by virtue of other Chapters of the Treaties
• To achieve high-level policy goals (such as the SDGs) and tackle key global or European challenges (e.g. climate change or pandemics), the EU requires a strong and timely evidence base. This suggests the need to create further critical research mass in key areas. • EU funded research should inform and provide evidence for the development of future policies. As one of the major research-performing actors within the RTD Framework Programmes, universities are well-placed to contribute through excellent science to high-quality policy-making. • There needs to remain a clear balance between bottom-up, curiosity-driven research, and

Problems hindering the pursuit of the objectives outlined in Article 179
top-down research, with strategic 'directionality' (in which there are investments in certain areas and challenges). • Universities play a crucial role in curiosity-driven research, which is by definition longer-term, and remains vital to enable society to address future as yet unidentified challenges. However, curiosity-driven research may also provide understanding of and solutions to current challenges. • However, there are weaknesses in transferring societal knowledge generated by universities to the economy and society more efficiently and swiftly. For example, there is no sufficiently structured way of mobilising curiosity-driven knowledge to solve a certain challenge (this requires, for instance, Open Science, AI, and data mining skills). • Irrespective as to whether the research concerned being undertaken by universities is challenge-led or frontier-led, the solution to the challenges should be left up to researchers and scientists. Many universities in countries that spend less in R&I and perform less well in accessing competitive research funding have been *de facto* excluded from contributing towards European strategic research agendas and from taking part in excellent research.
EU interventions must uphold and promote values and rights
• The authority of scientific evidence to help resolve political debates is being challenged in an era of fake news and the dismissal of scientific evidence for alternative theories, At the same time, the traditional role of universities as information 'gatekeepers' is being weakened. • The willingness of public actors, including governments and policy-makers, to base their actions on scientific evidence, has not always been apparent as public actors have often been reluctant to create structured mechanisms for scientific input to policy-making, and selective in using scientific advice where it suited their political objectives. • The rapid pace of technological advancement creates the risk that policy and ethical frameworks do not keep pace with the risks raised by such advancements, particularly where such risks are not clearly or widely understood (e.g. for instance linked to the privacy implications of research)[75]. • As and when universities engage with non-academic sectors, they need to retain their academic freedom and commitment to research integrity and scientific ethics. • There is a gender gap in women progressing through their academic careers through the documented "glass ceiling", at least for leadership positions. • While university leadership may prioritise diversity and inclusion, this is not always echoed in research positions at the level of faculties and departments due to a lack of awareness, training and funding, also among the diverse target audiences. • Academic freedom, knowledge, FAIR data security and research integrity may be at risk from interference by national or foreign governments.

3.6 From objectives to actions (transformation modules in the field of research and innovation)

The summary presented in the table above shows that the achievement of the objectives is hindered by a range of challenges, some of which relate to more than one objective. In order to address these problems – and thus achieve the objectives – there is a need to identify areas where the EU can take action to support universities and empower them over the period up to 2030.

[75] In an Evaluation of Three Years of the Operations of the ERCEA 2015-2018, the evaluators noted that under the ERC grants, there have been challenges to take data protection and privacy into account across all types of projects, but this was especially true of the SSH, where data collection raises ethical issues more frequently. More ethics reviews are carried out of SSH projects than for other types of projects.

To help the identification of priority areas for EU invention to empower universities to make the transformations, the concept of "transformation modules" (TMs) is proposed. The modules should guide the choice of future activities to facilitate the transformation of universities in the fields of research and innovation. They reflect the current strengths and weaknesses of Europe's universities and take account of the opportunities and challenges that they face. Each TM highlights the desired characteristics of universities by 2030 and beyond and shows how the EU needs to support all universities if the 2030 Vision to be fulfilled, whilst also allowing for the diversity of universities and taking account of the different contexts. The articulation of each transformation module will inform EU policy, EU programmes and related EU instruments for the next decade.

Given the heterogeneity of universities in Europe, the extent to which transformation is needed across different thematic areas will vary greatly between different types of universities and different countries. The intention is therefore that the transformation modules will need to be implemented in a flexible way by the European Commission and other EU-level actors with a role to play (e.g. the European Research Council's Scientific Committee, the EURAXESS network) and by individual universities and by their representative organisations, such as the university networks.

The transformation modules offer the opportunity to:

- Identify current challenges for universities in the field of research and innovation;
- Clarify the priority transformations that need to take place over the next decade and beyond (whilst respecting that the nature of such transformations is specific to the individual needs and priorities identified by each university);
- Highlight and describe areas where action has already been taken successfully and what results have been achieved; and
- Suggest possible means of strengthening the EU policy framework to support universities in implementing their research and innovation missions that could be undertaken by the EU over the next decade, with a focus on technical support measures and ways of strengthening the framework conditions
- Consider how far existing EU programmatic instruments are addressing the challenges, and whether EU funding could be used in new and different ways; and
- Suggest possible actions that could be taken by individual universities, with flexible implementation envisaged to reflect the fact that some actions will be highly relevant to some universities, but not to others.

The next section presents the proposed set of transformation modules in more detail.

4. Transformation modules in the field of research and innovation

4.1 Introduction – transformation modules as empowering agents of change

In the previous section, the analysis of the 2030 Vision and the objectives was presented. In this section, the Vision is translated into a set of transformation modules to empower universities and networks of universities in Europe.

The 2030 Vision identifies a series of high-level priorities and issues. These need to be transformed into specific policy actions across a wide range of areas to empower universities to make the changes that they identify as being necessary to their institution in the context of a set of commonly-agreed priorities in the field of research and innovation. The broader context of the original six priorities in the European Research Area (ERA), as well as the new priorities in the revitalised ERA Communication of 8 July, 2020 have shaped the definition of the Transformation Modules (TM). The modules were also closely defined as a result of stakeholder feedback from universities and university networks at European and national level, as well as from the European Commission's Steering Committee, comprised of many different policy units interested in the issues addressed from DG RTD and DG EAC (covering a wide range of areas such as open science, research infrastructures, MSCA, HEInnovate, Widening).

Some modules, such as governance, human capital and open science have a strong cross-cutting dimension, and the interlinkages between the modules are made clear through cross-referencing.

Table 4-1 - Transformation modules

Transformation modules
• TM1: Governance issues for the 2030 Vision, and legal framework for university cooperation in research and innovation.
• TM2: Maintaining trust and research integrity.
• TM3 - A strategic European Research and Innovation agenda: the central role of universities as research actors.
• TM4: Strengthening human capital and working conditions in universities.
• TM5: Fostering increased knowledge transfer and collaboration between academia and non-academic sectors
• TM6: Knowledge-driven universities in the context of digital changes – the transition to open science (through FAIR and open data), open access and open education.
• TM7: Optimising universities' role in research infrastructures.

The different transformation modules are now outlined.

4.2 TM1: Governance issues for the 2030 Vision and legal framework for university cooperation in research and innovation

4.2.1 Introduction

The governance of universities is fundamental to their operations and thus to their transformation in the context of the 2030 Vision. Governance serves as an "overarching" or "horizontal" theme, which sets the context for the other TMs. It encompasses a range of issues related to national frameworks, funding provision, and institutional governance models, as well as issues related to cooperation between universities. Across the EU, there is considerable diversity in the framework conditions, regulations, decision-making and

implementation processes governing the way in which universities operate. In some countries, universities operate on a "social" model, which features a central role for state involvement, a focus on widening access, and emphasis on the democratic and societal role of universities. In other countries, the university sector is based more on a "market-driven" model, featuring greater involvement of private and for-profit actors, deregulation, quasi-markets, public-private partnerships and an instrumental, market-driven approach to research with a high emphasis on outputs, such as graduates, publications and patents. Given this dichotomy, the EU's role is not to seek to impose one model over another. Rather, when considering a 2030 Vision, there is a rationale for EU intervention to address a number of governance challenges that are common to much of Europe's university sector, as will be set out below.

4.2.2 Challenges

Challenge 1: Existing national frameworks and institutional governance models are not always well-adapted to allow universities to fulfil their potential in research and innovation.

There is a need for national governance frameworks that are supportive of universities' R&I function. The EUA highlights the need for national frameworks built on three fundamental principles: sustainable and adequate funding (see Challenge 2 below); sufficient organisational, financial, staffing and academic autonomy; and flexible governance. According to the EUA, an ideal degree of autonomy allows universities to pursue new sources of income, optimise governance and management modes and to be more responsive to internal and external changes.[76] However, the EUA's 2017 "Scorecard" on autonomy has revealed a persisting lack of a global view on university autonomy when designing and implementing reforms at national level.[77] The EUA also notes that national higher education systems in most EU Member States still prescribe the form of governing bodies and that regulations may limit their size and also affect their composition, which limits universities' ability to strategically populate their governing bodies.[78]

There is – and should be – a diversity of institutional governance models, reflecting not only national contexts and traditions, but also the different (regional and international) missions of different universities. Each governance model will have its strengths and weaknesses. However, these models will determine in what ways and to what extent universities engage in R&I. According to the EUA, a key feature of effective governance should be the involvement of external members on universities' governing bodies, as this is important for accountability, social outreach and enhanced connections with other economic sectors.[79] However, any external members should fully respect universities' autonomy; for example, if external members are government appointees, this will not (necessarily) be a positive thing.

Yet in some countries, national regulations regarding the composition of governing bodies limits the ability of universities to recruit external members who can help promote their R&I mission. Examples cited by university networks, such as YERUN, that hinder closer cooperation between universities in different countries include civil service legislation, differences as to whether there are tuition fees (and where applicable, at which levels), and whether when doing a PhD, an individual's status is as a student or an employee.

[76] Estermann, T., and Kupriyanova, V. (2019). *Efficiency, Effectiveness and Value for Money at Universities*. EUA. Available at: https://eua.eu/downloads/publications/efficiency%20effectiveness%20and%20value%20for%20money.pdf
[77] Pruvot, E. B., and Estermann, T. (2017). *University Autonomy in Europe III: The Scorecard 2017*. EUA. Available at: https://eua.eu/downloads/publications/university%20autonomy%20in%20europe%20iii%20the%20scorecard%202017.pdf
[78] Estermann, T., and Kupriyanova, V. (2019). *Efficiency, Effectiveness and Value for Money at Universities*. EUA. Available at: https://eua.eu/downloads/publications/efficiency%20effectiveness%20and%20value%20for%20money.pdf
[79] Idem.

To overcome these barriers, some members also noted that it would be helpful for universities if the path towards a common European legal entity could be simplified.

Challenge 2: Currently, some models of university funding and some forms of finance for R&I are hindering universities in their R&I function or are producing undesirable effects.

In the wake of the financial crisis, many universities have experienced increasing financial pressure and the basis for their funding has been changing. In almost all Member States, competitive sources of research funding – both public and private – are now a major factor. This is creating new opportunities, particularly where governments or industry have increased their investment in R&D. At the same time, there is the risk that some universities become overly-focussed on meeting the requirements of performance-based R&I funding, to the detriment of fundamental research and their wider mission(s), such as engagement in society).

Similarly, the drive for efficiency and value for money can raise performance but may risk adverse effects, for example, in relation to quality or niche areas of research that are considered "unprofitable". It may also limit universities' ability to hire staff, invest in modern infrastructure and improve the quality of research.[80] Competitive funding offers the potential to raise the performance of all players but also risks widening disparities between high-performing institutions and other universities (and between high-performing Member States and other Member States). This disparity has in fact been a feature of the EU's Horizon 2020 programme, with the Commissioner for Innovation, Research, Culture, Education and Youth stating her intention to address a situation in which the 13 countries that joined the EU since 2004 have received just 4.8% of total EU R&I funding, as they have low success rates in the EU RTD Framework Programmes.[81]

Challenge 3: The diversity of national frameworks raises challenges for co-operation between universities in R&I across Europe.

Universities increasingly need to cooperate with other institutions internationally, both within the EU and beyond. This is in part for strategic purposes, for example, to make sure that their researchers are able to cooperate internationally, as a means of strengthening scientific and research excellence in order to fulfil their potential in R&I and to improve their contribution to the SDGs. However, the situation varies widely: some universities are especially interested in international cooperation at an institutional level, such as those taking part within the framework of the European University Initiative.

There is also positive international cooperation taking place between universities through policy development and other work of EU university network associations such as LERU, YERUN and The Guild (among others).

At the same time, Member States are keen to retain their regulatory autonomy and competence in respect of their universities. While Member States enjoy the partnership of ERA as an open public space for R&I, they continue to regulate and steer universities as if they are a closed system. There is a high degree of diversity in the national framework conditions, regulations, and implementation processes governing the way in which Europe's universities operate. For example, universities in different Member States enjoy different levels of academic freedom and institutional autonomy. According to the EUA, a

[80] Estermann, T., and Kupriyanova, V. (2019). *Efficiency, Effectiveness and Value for Money at Universities*. EUA. Available at: https://eua.eu/downloads/publications/efficiency%20effectiveness%20and%20value%20for%20money.pdf

[81] Zubascu, F. (2020). New R&D commissioner aims to 'revitalise' European Research Area, for east and west. [online] Available at: https://sciencebusiness.net/news/new-rd-commissioner-aims-revitalise-european-research-area-east-and-west

high degree of organisational and staffing autonomy also allows universities to cooperate better (e.g. through shared services, collaborative procurement and research partnerships).[82] On the other hand, universities in some countries may not enjoy the level of autonomy necessary for such cooperation. In the context of developing a 2030 Vision for their future in a revitalised ERA, universities will need support from the EU to effectively find common ground in terms of their governance arrangements and funding models in order to be able to enhance their cooperation within the ERA, combine resources, and thus remain relevant players locally and successful competitors globally.

Challenge 4 – The question over the longer-term sustainability of transnational cooperation between universities in the field of research and innovation

The situation has arguably improved since the creation of the Erasmus+, Horizon 2020 funded European Universities Initiative (EUI), which provides a mechanism through which universities can cooperate jointly on a pan-European basis, with initial funding for three-year pilots to establish transnational alliances of HEIs developing long-term structural and strategic cooperation.[83] During the first two pilot calls held in 2019 and 2020 respectively, 41 European Universities alliances have been selected involving more than 280 higher education institutions (HEIs) from 27 Member States.

This initiative is in its infancy and holds considerable promise. The aim is to test different models of cooperation, which will be disseminated across Europe, so that other higher education institutions can also benefit and learn from the selected European Universities. Horizon 2020 will complement the European Universities initiative in 2020 with a top-up for the research dimension. The objective is to provide each European University selected under the Erasmus+ programme with an additional 2M€ specifically targeting their R&I dimension. Through this Horizon 2020 top-up, European Universities are expected to test the different aspects of their institutional transformation related to research and innovation, in complement to the Erasmus support.

Some stakeholders raised the issue of the initiative's sustainability in terms of the need for new legal mechanisms to overcome challenges so as to be able to work together at a European level on a more permanent basis. For example, an article by the EUA from December 2019 points out that "an important question is how many of these deep alliances and networks will there be at the end of the initiative and what is sustainable for the system as a whole".[84] This relates to the question of funding, as the article notes, "it seems clear that resources made available currently under the Erasmus+ programme are not sufficient and are not intended to cover the costs of developing such deep alliances.

It will be important for the EU, as well as individual countries, to find a balance between supporting such alliances and funding smaller scale collaboration projects that are in high demand under the current Erasmus+ programme".

However, according to feedback received during the two workshops, sustainability-related issues extend beyond funding alone, as there can be national legal barriers to forging closer transnational cooperation by universities at the European level. Some stakeholders have therefore suggested that the possibility of introducing a new European legal statute should be considered to enable those universities that wish to do so to work together on a more permanent basis.

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[82] Estermann, T., and Kupriyanova, V. (2019). *Efficiency, Effectiveness and Value for Money at Universities*. EUA. Available at: https://eua.eu/downloads/publications/efficiency%20effectiveness%20and%20value%20for%20money.pdf

[83] https://ec.europa.eu/education/education-in-the-eu/european-education-area/european-universities-initiative_en

[84] European Universities Initiative – Chances and challenges, Anna-Lena Claeys-Kulik, the EUA 6 November 2019 https://www.universityworldnews.com/post.php?story=20191106144804387

Regarding feedback from the university networks on the utility of these legal instruments, some of YERUN's members noted that it would be helpful for universities if the path to a common European legal entity could be simplified, as they pointed out to the need to overcome national regulations to transnational cooperation. This could also be beneficial, for example, when applying for joint Erasmus mobility funds.

Challenge 5: Legal barriers to the free movement of researchers and barriers to the free movement of knowledge ("fifth freedom") remain at EU level.

Universities are not only affected by policy frameworks relating to higher education and R&I, but also by wider legal and regulatory frameworks. There remain outstanding legal obstacles that could hinder the free movement of researchers and knowledge generally within the EU-27. For example, many researchers face difficulties, as do other workers, regarding the portability of social security and pension rights impeding their free movement. This is due to the lack of harmonisation on social security between Member States.[85] There are also different administrative or legal requirements relating to posted workers, as well as the different national and even institutional rules or mismatches hampering joint delivery or recognition of PhD degrees or other R&I relevant qualifications. Similarly, the differing national rates of VAT can make equipment more expensive in some Member States than in others. Whilst these challenges affect all sectors of the economy, they can have direct relevance to free movement of knowledge and on transnational co-operation in R&I. Taken together, these barriers to the completion of the single market serve to hinder researcher mobility and thus risk impeding the realisation of the ERA.

4.2.3 Transformation needs

EU and national policy frameworks and funding models should help universities to align their governance models in a way that enables them to remain relevant and entrepreneurial to society. Ultimately, they should be supported in their efforts to generate and disseminate the knowledge required to meet societal challenges.

The governance models of 2030 will need to be characterised by:

- A degree of autonomy that is appropriate to their R&I mission within the parameters set by the Treaties on the European Union (TEU), the TFEU and the EU Charter on Fundamental Rights (see section 3.2);
- Institutional ability and freedom to co-operate internationally, nationally and locally with other universities, research organisations, industry and citizens and society at large;
- Ability to adequately benefit from and respond to the free movement of knowledge, knowledge workers/researchers and students/learners;
- Financially-robust institutions accessing a diversity of income streams;
- Funding streams that reward performance in a revised incentivising system for researchers;
- Efficient management that delivers value-for-money, whilst protecting quality.

Art. 187 of the TFEU provides an interesting model that could allow scope for creative solutions to be developed to facilitate cross-border and transnational cooperation on research agendas of common interest across groups of universities in different EU countries. Art. 187 states that the Union may "set up joint undertakings or any other structure necessary for the efficient execution of Union research, technological development and demonstration programmes." However, some stakeholders taking part

[85] Gurthrie, S., Lichten, C. A., Harte, E., Parks, S., and Wooding, S. (2019). *Understanding Researcher Mobility*. RAND. DOI: https://doi.org/10.7249/RB9968. Available at: https://www.rand.org/pubs/research_briefs/RB9968.html

in the consultation process have argued that the Joint Undertakings (JU) are not suitable, as they may reinforce existing disparities in access to research funding to pursue scientific excellence.

However, there are other types of legal mechanisms (see success stories), such as the European Research Infrastructure Consortium (ERIC) and the European Grouping of Territorial Cooperation (EGTC) that would provide a suitable EU level legal framework for universities to cooperate. The main advantage afforded by Art. 187 is that it allows significant flexibility to enable research actors to come together.

4.2.4 Case studies and success stories

The first example relates to the identification and overcoming of legal barriers to cooperation between universities through the European Consortium of Innovative Universities (ECIU), a consortium of universities involved in the first call for proposals on European Universities, which is part of the first 17 piloting University Alliances under the Erasmus+ European Universities Initiative (EUI).[86]

European Consortium of Innovative Universities network - ECIUn

Project implementer: The ECIUn European University (ECIUn) is comprised of 11 universities (University of Twente (The Netherlands) Aalborg University (Denmark) Dublin City University (Ireland) Hamburg University of Technology (Germany) Kaunas University of Technology (Lithuania) Linköping University (Sweden) Tampere University (Finland) Universitat Autònoma de Barcelona (Spain) University of Aveiro (Portugal) University of Stavanger (Norway) University of Trento (Italy)), which already have a long-lasting cooperation through the European Consortium of Innovative Universities (ECIU).

Programme funding and duration European Universities Initiative: Following up on the European Council Conclusions of December 2017, the European Commission has developed the European Universities Initiative (EUI) under the Erasmus+ programme, and announced already two calls for proposals, funded as part of the Erasmus+ programme. European Universities are ambitious transnational alliances of HEIs developing long-term structural and strategic cooperation. Alliances need a joint long-term strategy for education with, where possible, links to research and innovation to drive systemic, structural and sustainable impact at all levels of their institutions. European Universities must create a European higher education inter-university 'campus', where: students, staff and researchers enjoy seamless mobility (physical or virtual) to study, train, teach, do research, work or share services at cooperating partner institution; where transdisciplinary and transnational teams of students, academics and external stakeholders tackle big issues facing Europe (such as digitalisation, climate protection, democracy, health, big data, migration) and where students can design their own flexible curricula, leading to a European Degree. The ECIU University is one of 17 successful applicants during the first pilot project. The funding to the ECIU University will run for 3 years. A maximum of 5 million euro has been made available from Erasmus+ for each selected European Universities to strengthen their collaboration.

Horizon 2020 will complement the European Universities initiative in 2020 with a top-up for the research dimension. The objective is to provide each European University selected under the Erasmus+ programme with an additional 2M€ specifically targeting their collaborative R&I activities. Through this Horizon 2020 top-up, European Universities are expected to test the different aspects of their institutional transformation related to research and innovation, in complement to the Erasmus support.

Description of activities ECIU University: Whilst many different activities will be funded, some of these are governance-related activities. For example, the ECIU University is in the process of performing an analysis of legal barriers to the creation of a European University, including alternatives for a trans-European university as a legal entity, as well as joint structures and implementation of joint services on a transnational basis. The ECIU's work on governance will involve conducting an extensive analysis of obstacles and pathways to the reform of institutional governance in universities at the European level. The ECIU University is piloting a new European

[86] European Commission. (2019). *European Universities: A key pillar of the European education area.* Available at: https://ec.europa.eu/education/sites/education/files/document-library-docs/european-universities-initiative-factsheet.pdf

European Consortium of Innovative Universities network - ECIUn

University model, with joint governance, joint structures and services to enhance university cooperation.

Key achievements/lessons learned: Although the ECIU University is at an early stage in implementation, if ways can be identified of reforming institutional governance within universities through intra-University cooperation at European level, this will provide a strong catalyst to promoting governance reforms both among individual universities (where these enjoy strong autonomy) and at the national level, where national authorities responsible for higher education sometimes play a strong governance role. By addressing governance in transnational partnership working at EU level, legal challenges could be overcome at the national level.

Replicability/transferability potential: European Universities will be disseminating good practices linked to their model once available and tested.

Sources of further information: The European Consortium of Innovative Universities (ECIU) - www.eciu.org

The second example examines possible means of overcoming national legal obstacles through the use of innovative instruments. It draws on a legal study carried out on behalf of the European Commission's DG RTD in 2020.[87]

Establishment of a legislative framework at EU level to eradicate barriers to the free movement of researchers and to facilitate trans-national cooperation in research and innovation between universities wishing to cooperate.

Objectives: Establishment of a legislative framework at EU level which encourages core stakeholders in the areas of research and innovation to take action to overcome existing outstanding legal barriers. This could be achieved through a European Research Infrastructure Consortium (ERIC),[88] a European legal entity in which each of the members (in different Member States) is a legal entity under the law of the Member State in which it is located.

Description of activities: This would provide an ambitious means to encourage synergies bottom-up could be the establishment of a legislative framework at EU level which encourages core stakeholders in the areas of research and innovation to take action. Such frameworks already exist in the areas of research and innovation and cross-border cooperation. Here, particular reference should be made to the **European Research Infrastructure Consortium (ERIC)** and the **European Grouping of Territorial Cooperation (EGTC)**.[1]

In contrast to an ERIC, a European Grouping of Territorial Cooperation (EGTC) is an EU legal instrument to facilitate and promote cross-border, transnational and interregional cooperation in both border and non-border regions by creating a European legal entity. The EGTC ensures that a selection of one of the two (or more) Member States' legal systems is made, meaning that issues regarding conflicts of national laws concerning the organisation of the legal entity are mitigated since a choice is made as to the applicable legal system.

In 2018, the Commission proposed a new instrument to complement the **EGTC,** [3] a European Cross-border Mechanism (ECBM), which provides cross-border projects with the possibility to choose one set of applicable legislation where a conflict of national laws arises on a certain topic. Whereas the applicable legislation of one Member State would be applied, the conflicting legislation of the other Member State involved would be "disapplied" exceptionally with regard to the cross-border project.

Lessons learned: Structures such as the ERIC, EGTC and ECBM provide inspiration for the development of similar tools for stakeholders in different Member States looking to cooperate on research and innovation. However, another way to stimulate grass-roots projects is through

[87] Comandè, F. and Kortese, L. (2020). *Legal Instruments in Support of EU Policies In Education, Research and Innovation* - Cataloguing the Basis for EU Action Legal Study.
[88] European Commission (n.d.) European Research Infrastructure Consortium (ERIC). [Online]. [Accessed 15 May 2020]. Available at: https://ec.europa.eu/info/research-and-innovation/strategy/european-research-infrastructures/eric_en

Establishment of a legislative framework at EU level to eradicate barriers to the free movement of researchers and to facilitate trans-national cooperation in research and innovation between universities wishing to cooperate.

financing within spending programmes for education, research and innovation. As such, the promotion of grass-roots policy building represents a sub-category of financial incentives. Policy-building projects are currently possible, for instance, under the Key Action 3 (Support for Policy Reform) of Erasmus+ and under the Horizon 2020 Specific Objective "Spreading excellence and widening participation". Such activities span from the creation of forums for the exchange of good practices, the analysis of common issues, the setting up of coordination platforms among managerial bodies from different education or research institutes, the promotion of protocols to overcome bureaucratic hurdles, the establishment of administrative cooperation and the organisation of exchange missions.

Replicability/transferability potential: The above-mentioned legal mechanisms could serve as inspiration for developing further legal means for universities to cooperate with one another at a European level.

Sources of further information:

1) Council Regulation (EC) No 723/2009 as amended by Council Regulation (EU) No 1261/2013 and Regulation (EC) No 1082/2006 as amended by Regulation (EU) No 1302/2013.
2) For an analysis of the EGTC in the area of education see H. Schneider and J. de Groof (project leaders) (project team: V.Borger, S.Claessens, S.Garben, A.Hoogenboom), Cross-border university co-operation: Crossing border – Frontier Knowledge, Report to the Dutch and Flemish Ministries of Education, Culture and Science, 2009.
3) See COM(2018) 373 final.

Source: adapted from the study "Legal Instruments in Support of EU Policies in Education, Research and Innovation - Cataloguing the Basis for EU Action" F. Comandè and L. Kortese, February, 2020. Reproduced with kind permission of the authors.

The third example relates to cross-border cooperation between universities through leveraging the potential of university networks.

Cross-border cooperation between five universities in France, Germany and Switzerland

Objectives: The aim is to develop a distinct and internationally attractive area of knowledge and research by *inter alia* providing doctoral candidates with an innovative approach to their doctoral training. This leads to a binational or trinational doctorate.

Description of activities: In the Upper Rhine region, the universities of Basel, Freiburg, Haute-Alsace and Strasbourg together with the Karlsruhe Institute of Technology (KIT) are breaking new ground in cross-border cooperation. They have initiated a trinational university grouping called "Eucor – The European Campus", which is a university network covering teaching, research, innovation and administration. The network strengthens common links and seeks to maximise complementary aspects and to create synergies.

The university is situated in three different European countries, France, Germany and Switzerland. The universities are located within relatively close proximity (200 kilometres between the five universities participating).

The concept behind the Upper Rhine region's shared campus is innovative cross-border cooperation. For instance, doctoral candidates from all five universities can take courses at the GRACE Graduate Center of the University of Basel or at the University of Freiburg's Center for Key Qualifications, and have the same rights to use university services. The universities are also developing concepts related to the shared use of research infrastructure, with the goal of making

Cross-border cooperation between five universities in France, Germany and Switzerland

efficient use of resources and enabling synergies as well as multiplying the possibilities for research by doctoral candidates.

Innovative characteristics:

1. **The focus on inter-university cooperation**. The research landscape extends beyond the potential of a single university by combining doctoral training across five universities coming together as a single, multi-location campus. Extensive cooperation already takes place in the field of doctoral studies between the universities concerned, such as the *cotutelle de thèse option*, a joint doctoral supervision agreement between two or more different higher education institutions, which can lead to a binational or trinational doctoral degree. This aims to intensify international cooperation in research while simultaneously increasing the mobility of doctoral candidates. It creates the possibility of earning a doctoral degree at two universities at once, on the basis of one dissertation. In addition, there is also the possibility of earning a structured cross-border doctoral degree in shared doctoral colleges.

2. **The ability for doctoral candidates to benefit from cross-border networks through cooperation between the universities across their research functions as a whole.** Some subject areas have established networks that promote the exchange of knowledge between researchers, doctoral candidates and other students at the five universities. An example of a thematic network is the *"Eucor English"* network – a forum for intercultural exchange that brings together specialists in anglophone literature and culture as well as in linguistics at the partner universities. Each year the network organises workshops and trinational meetings and seminars for master's and doctoral candidates to exchange the results of research and initiate joint projects. There are similar networks in neurosciences, Scandinavian studies and classical studies.

Lessons learned:

The added value of the project is the diversity and wide variety of perspectives. Combining various specialisations and approaches, often shaped by national ideas, raises new questions. Using different laboratories and facilities can be complementary and expand the options for a university. Intercultural exchange sharpens ideas and enriches research. It opens doctoral candidates to a research landscape that goes beyond the potential of a single university.

Replicability/transferability potential: the scheme could be replicated in other cross-border areas, but the approach has some limitations, such as the need for relative geographic proximity.

Sources of further information: https://eua-cde.org/the-doctoral-debate/10:cross-border-doctoral-education-at-the-european-campus.html

4.2.5 Possible actions

EU level

At EU level, there is a need to consider which type of regulatory reforms could be introduced within the parameters set by the Treaties, including those articles relating to the internal market, to trade and to the horizontal policy requirements of upholding values and non-discrimination.

The scope to leverage existing mechanisms to enable universities to work together using innovative legal structures could be explored, through wider use of the **European Research Infrastructure Consortium (ERIC)** instrument for universities wishing to cooperate in this area, and the **European Grouping of Territorial Cooperation (EGTC)** in the case of universities in cross-border areas and on a transnational basis.

In addition, consideration could be given to the potential role of new legal structures that could be created under Art. 187 which could, in a similar vein to those identified above, facilitate joint working on research challenges of common interest across groups of universities in different countries. This could build on existing initiatives such as the

European Universities initiative, but move beyond these to allow scope for even deeper cooperation.

If new legal mechanisms were to be developed, these could overcome existing regulatory obstacles to cooperation identified under the governance TM, and make it easier to leverage the universities in Europe that already belong to European level university networks that already foster cooperation between research and technology-focused universities.

Regarding **new legal instruments,** the research has identified two possible new legal instruments for universities, the **European Statute** and a **Framework Directive**.

- A European Statute could be developed as a new instrument to provide a formal legal status to universities engaged in transnational intra-university cooperation. [89] Such an initiative could be possible, but is complicated. There is no specific EU legal statute to date, but the three that have been mentioned in the case study (the EGTC, the EIT KICs, and the European University Alliances in the EIU) provide examples as to which kind of cooperation models this might be based on. An EU-level legal status would enable universities to overcome some of the national legal barriers that may prevent such cooperation in some countries.
- Such a Statute could also provide an enabling legal mechanism regarding the possibility in the medium to longer term of putting in place an EU regulatory framework that would allow the scope for mergers between two (or more) universities in different EU countries through the creation of transnational institutions. Whilst mergers of universities are currently possible under EU law, there are complex obstacles to going ahead with mergers.
- Within a single market and ERA context, there could be advantages in by enabling such mergers to take place, in overcoming national barriers, where universities wish to pursue particularly deep cooperation that would allow them to go beyond the current confinements of the European University Initiative (EUI), should they identify strategic benefits in doing so.
- To address concerns relating to the emergence of national barriers to the free movement of researchers (e.g. portability of social security and pension rights, others), the Commission could explore the feasibility of proposing a short and straightforward framework directive. This has been done previously in environmental EU legislation.
- The framework directive "should stipulate the goals, principles, instruments, actors and actions of the EU in the field of research and innovation and give every EU citizen the right to challenge domestic measures that block the ERA. This would impose no active obligations on member states, only passive prohibitions. Member States should refrain from introducing domestic legislation or policies that block the free circulation of knowledge, in so far as possible. Such a directive should respect the principles of EU action as laid out in the Treaty on the Functioning of the EU: attribution, subsidiarity and proportionality, whilst respecting the proportionality principle". [90]
- Any legal obligations to facilitate the free movement of workers would of course be circumscribed and counterbalanced by equally important values and goals of ERA, which include quality labour conditions for academic staff, including an encouragement to enhance and broaden tenure-track opportunities and long-term stable employment.

[89] Some of the European University initiatives, such as the ECIU and CHARM are also exploring the potential benefits of, and issues concerned by a possible future European Statute. There is also presently an assignment under the European Universities Call to explore the feasibility of a European Statute.
[90] Deketelaere, K. *Three scenarios for completing the European Research Area*.

A framework directive, if acceptable, would address the general free movement of persons for an important segment of the population and the economy: persons and activities related to knowledge production and exploitation. A summary overview of these legal and regulatory actions is provided in the following box:

Possible legal or regulatory actions at EU level

- **Reduce regulatory pressure** on R&I at national and European level by doing away with or simplifying existing rules, for example as regards research funding.
- **Extend** the use of **existing legal instruments** for inter-university cooperation, such as **legal instruments under Art. 187, the European Research Infrastructure Consortium (ERIC)[91] and the European Grouping of Territorial Cooperation (EGTC), a European legal instrument designed to facilitate and promote transnational and interregional co-operation.**
- Develop a separate **European University Statute** for universities as single institutions or cooperatives wishing to optimise their performances in R&I (plus education and training), to strengthen or sustain institutional autonomy and academic freedom and/or to manage collectively their university commons* such as research infrastructures and knowledge bases.
- Propose other legal instruments based on the **EU Charter on Human Rights** (e.g. academic freedom, freedom of expression and information) combining **Treaty** provisions on horizontal policy requirements (e.g. non-discrimination) on **research & innovation** (e.g. achieving a European research area) as well as **internal market and trade** (e.g. trade agreements) to create a **level playing field**, promoting and protecting European R&I interests globally and internally.
- **Adopt an EU Framework Directive in the field of R&I** obliging Member States and EU to refrain from and abolish measures that impede the free circulation of knowledge. This directive would also contain measures to **empower** researchers, innovators and universities to claim and obtain their rights **bottom-up.**

*Frost, J., & Hattke, F. (2018). Governing Collective Action–The Impetus for University Commons. *European Review*, *26*(S1), S70-S84

*Ostrom, E., and Hess, C. (2007). *Understanding knowledge as a Commons: from theory to practice*. Cambridge, Massachusetts: MIT Press.

Turning to further measures that the EU could support beyond the legal framework:

- The EU could also support wider transformations, by providing support to national policy frameworks, using EU funding programmes as a "lever" to transform national and institutional governance and through various soft instruments to promote good practice and disseminate experience.
- The EU could promote peer learning and benchmarking between Member States regarding their governance and regulatory frameworks for R&I at universities. In line with the fundamental principles proposed by EUA, this could particularly focus on funding, autonomy and flexible governance.
- Horizon Europe should continue providing top-up financial support to the Erasmus+ European Universities Initiative, thereby promoting systemic, strategic and sustainable cooperation between universities' R&I activities, which will help to further eliminate barriers in this field.
- At the university level, university networks could potentially be actively engaged in facilitating more cross-border and transnational cooperation between institutions through the medium of new EU-level legal structures.

[91] The EU legal framework for a European Research Infrastructure Consortium (ERIC) entered into force on 28 August 2009. This specific legal form is designed to facilitate the joint establishment and operation of research infrastructures of European interest.

National level

- In some countries, there is a need to modernise regulatory and policy frameworks and also to consider how funding can be used in support of transformation. The nature of such modernisation will vary from country to country. One suggestion is for governments to allow universities to choose the most appropriate internal governance model within an overall governance and accountability framework set at national level. This national framework would be in tune with wider European legal frameworks.

Universities

- Universities should reflect on what sort of governance models will be most appropriate to exploit R&I potential, as well as what is possible within the prevailing policy and regulatory framework. There will also be a need to devise governance solutions that draw on best practice in other institutions and that allow the university to fulfil its R&I mission.
- University leadership needs to be supported by effective opportunities for professionalization, including elements of modern public governance and management and through the scope for peer learning at a transnational level.

Using EU funding to support transformation

- Foster in parallel **small-scale and short-term cooperation** between universities and other actors with simplified procedures.
- Reserve additional means to help boost a limited number of comprehensive **universities** or cooperatives at a **European level that focus on STEM-SSH** cooperation that can **compete on a global scale** supported through a European excellence initiative drawing on experiences in Finland, France, the Netherlands, Sweden, Germany, UK and notably Switzerland (i.e. the two Swiss Federal Institutes, of Zurich and Lausanne, set up under a federal statute with more autonomy and more funding).

Using EU policy instruments to support transformation (e.g. codes, charters, policy support facility, etc.)

- Group existing charters and codes, such as the European Charter for Researchers and Code of Conduct for the recruitment of researchers[92] and the European Code of Conduct for Research Integrity into **a single institutional framework** for universities to enhance transparency and foster compliance.[93]

Soft actions at EU level to support transformation (disseminating good practice, peer review, studies, etc.)

- Streamline the soft actions at EU level around a limited number of self-imposed **institutional objectives and targets** published by universities and other academic R&I organisations and make them subject to agreements with public and private sponsors at regional, national and EU level.
- Develop **new metrics** to measure and monitor performances and refine existing instruments (e.g. revised peer review, less-is-more publications and further develop U-Multirank to ensure a multi-dimensional approach to benchmarking of HEI performance capable of monitoring achievement of education, research, innovation and service to society policies).
- Ensure that the **European Semester** process more explicitly includes national reporting on progress in research and innovation, including the monitoring of institutional funding allocated to universities.

[92] The Charter and Code sets out 40 general principles around the roles, responsibilities and entitlements of researchers, employers and funders with regard to research careers.
[93] ALLEA. (2017). *The European Code of Conduct for Research Integrity: Revised Edition*. Berlin: ALLEA. Available at: https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf

4.3 TM2: Maintaining trust and research integrity.

The second module focuses on maintaining trust in universities in Europe and ensuring research integrity. This module covers two different sub-modules:

- TM2.1 – Maintaining public trust in universities.
- TM2.2 – Research integrity and scientific ethics.

4.3.1 TM2.1 – Maintaining trust in universities.

This sub-module considers key issues relating to enhancing public trust in universities.

4.3.1.1 Introduction

Universities are generally trusted repositories and disseminators of knowledge, including knowledge generated through their scientific research activities and their outcomes. However, they increasingly operate in societies where expertise in general is questioned, especially in the context of the concept of post-truth politics[94] and the proliferation of misinformation via social media. For example, some EU citizens choose what to believe based on what they have read on social media and in alternative media sources rather than place their trust in traditional, trusted sources of information.

According to the Eurobarometer report about EU media use of May 2018 (TNS opinion social and Directorate-General Communications, 2018), the printed press is consulted everyday by 28% of the EU citizens, with a decreasing trend, whilst it is never consulted by approximately 20% of citizens. Conversely, daily access to the Internet increased up to 65% of the population (starting from a 45% in 2010) and the increase in the percentage of citizens using daily on-line social networks to access information is even more striking, changing from 18% in 2010 to 42% in 2017.[95] To clarify, increased access to the Internet and social networks is not inherently negative—indeed, such technological services offer numerous benefits, as we discuss in TM6. Rather, the risks presented by these increases—such as unregulated distortions of information, biased or skewed news sources, online conspiracy movements, and lay users being given as much credibility as experts on forums and blogging websites—are contributing to a decline in trust in academia, empirical research, and expertise.

This societal phenomenon affects all research-performing actors, including universities, as well as other areas of society beyond research alone. Governments and the mainstream media both face a risk of declining societal trust in expertise and evidence as well. This decline may have a multitude of causes—again, the rapid pace of technological change and online dissemination of false information has a critical role to play—but also previous instances of abuse and misuse of technology and the politicisation of research findings (which generates scepticism).

In carrying out their research mission, universities operate under increasing pressure, as science and research may be instinctively mistrusted by a certain percentage of the European and global populations.

Bottom-up feedback—collected during the workshops from universities and other stakeholders—points to ongoing problems regarding disinformation (including ‘’fake news’’) and its attendant impacts on public trust in scientific evidence. A briefing note by the Carnegie Endowment points out that disinformation continues to undermine public

[94] Defined as a situation in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief (Oxford English Dictionary, https://www.lexico.com/definition/post-truth)

[95] Becatti, C., Caldarelli, G., Lambiotte, R. and Saracco, F. (2019). Extracting significant signal of news consumption from social networks: the case of Twitter in Italian political elections. *Palgrave Communications, 5(1), pp.1-16.*

trust and that the self-regulatory approach put forward in the EU Code of Practice on Disinformation has not been that effective. The report goes on to say: "strong trust has not been built between industry, governments, academia, and civil society. Most importantly, there is more to be done to better protect the public from the potential harms caused by disinformation".[96] An example of the damaging effects of disinformation and distortion of scientific truths is provided below to illustrate the difficult environment universities and other research performing actors operate under.

Example of impacts of public distrust in science – lower vaccination rates

An example of the impacts of public distrust in science is the rise of anti-vaccination movements in many countries in Europe and globally, which have resulted in much lower vaccination rates. A consequence is the risk of an increase in diseases, in some cases for diseases that have been either partly or largely eradicated. There are examples of lower vaccination rates resulting from deliberate disinformation, misinformation, and scare stories being disseminated on social media.

For example, in Japan, a disinformation campaign by a religious group led to significantly lower vaccination rates, which in turn increased the incidence of measles.[97] Moreover, another misinformation campaign on social media in Japan led to a significant decline in vaccinations for cervical cancer, and a cessation of government-recommended vaccination against the human papillomavirus (HPV), leading to an increase in the incidence of the cancer. Yet, the researcher responsible for drawing the link between lower vaccinations and incidence of HPV was subjected to abuse on social media for her research.[98] The Japanese vaccination rate has fallen from over 70% to 1%.

There are similar examples in Europe of lower vaccination rates in some countries due to mistrust of science, paired with a cultural trend towards what could be termed "the public knows better than the scientists".[99]

Concerns about trust in science – as well as in government and public policy interpretation of scientific guidance – extends to how infectious diseases are being (and have been managed in the past) during a pandemic or epidemic situation. For example, a study from Switzerland revealed that "The 2009 H1N1 pandemic left a legacy of mistrust in the public relative to how outbreaks of emerging infectious diseases are managed".[100]

COVID-19 – Will the current coronavirus pandemic renew public trust in science?[101]

According to some of the university networks consulted for this study, the recent COVID-19 outbreak has partially reversed the declining levels of trust in science, as scientists have been sought after for their expertise and knowledge, by governments, the media and the general public.

[96] Carnegie Endowment. (2020). EU Code of Practice on Disinformation: Briefing Note for the New European Commission. Available at: https://carnegieendowment.org/2020/03/03/eu-code-of-practice-on-disinformation-briefing-note-for-new-european-commission-pub-81187.

[97] Ramzy, A. Ueno. H. (2019). Japan Battles Worst Measles Outbreak in Years. The New York Times. 22 February 2019. Available at: https://www.nytimes.com/2019/02/22/world/asia/japan-measles-outbreak.html. [Accessed 18 June 2020].

[98] Yagi et al. (2019) Epidemiological and Clinical Analyses of Cervical Cancer Using Data From the Population-based Osaka Cancer Registry. See also: https://www.asianscientist.com/2019/02/in-the-lab/hpv-vaccination-cervical-cancer-japan/ and https://www.theguardian.com/science/2017/nov/30/doctor-wins-2017-john-maddox-prize-countering-hpv-vaccine-misinformation-riko-muranaka and https://www.vox.com/science-and-health/2017/12/1/16723912/japan-hpv-vaccine

[99] European Parliament (2019). Vaccines: MEPs concerned about drop in vaccination rates in the EU. Available at: https://www.europarl.europa.eu/news/en/headlines/society/20180316STO99921/vaccines-meps-concerned-about-drop-in-eu-vaccination-rates. [Accessed 18 June 2020].

[100] Bangerter, A., Krings, F., Mouton, A., Gilles, I., Green, E.G. and Clemence, A., (2012). Longitudinal investigation of public trust in institutions relative to the 2009 H1N1 pandemic in Switzerland. PLoS One, 7(11). Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3504102/

[101] Grove, Jack. 2020. "Will the Coronavirus Crisis Renew Public Trust in Science?" Times Higher Education (16 March) Available at: https://www.timeshighereducation.com/news/will-coronavirus-crisis-renewpublic-trust-science

[102] Nonetheless, there is a question mark as to how sustainable increased trust in scientists and in science is observed during the pandemic. Some observers have argued that the jury is still out. [103]

As an article in Vox-EU highlights, "the coronavirus crisis has put a spotlight on the importance of science in supporting our nation's well-being" (Shepherd 2020). Concurrently, the pandemic has put on display certain leaders' "longstanding practice of undermining scientific expertise for political purposes" (Friedman and Plumer 2020), conceivably with negative implications for how the public views science and scientists".

On the one hand, since the crisis began, trust in science appears to have risen, for example, in the UK and in Germany. [104] The proportion of Germans in an April 2020 survey who said that they trust science and research "wholeheartedly" increased to 36% in mid-April. "This is four times the proportion recorded in the same survey in 2019 and substantially higher than in earlier years. Another 37% said that they were "likely" to trust science and research. A fifth were undecided, while six% were lacking in trust". [105]

In the UK, a survey commissioned by the Open Knowledge Foundation, found that nearly two-thirds of respondents said the pandemic had made them more likely "to listen to expert advice from qualified scientists and researchers".[106]

However, by June 2020, evidence was emerging from some European countries that this increased trust in science has diminished somewhat due to a complex range of factors, such as the politicisation of scientific advice,[107] a limited number of populist scientists contradicting the consensus among scientists (e.g. on whether hydroxychloroquine is safe) and policy u-turns in many EU countries on whether wearing face masks was advisable and scientifically sound. For example, according to an article in the Times Higher Education (THE), a recent survey revealed that "the French public has lost confidence in scientists during the coronavirus pandemic, largely because of a policy U-turn over face masks". Moreover, "science policy experts have warned that researchers could face a backlash from a frustrated public as lockdowns drag on and a blame game begins".

Regarding populism, in France, the Times Higher Education article notes that a "populist" microbiologist has vocally championed hydroxychloroquine, the treatment touted by US President Donald Trump. An interviewee for the article commented that the scientific debate had become "polarised, and public trust likely damaged. The public see one prominent medical professor saying he has a good answer to the disease and the government doesn't want to use it".[108]

Sylvain Brouard, research director of the National Political Science Foundation at Sciences Po, who has been tracking public opinion in France during the pandemic commented in the THE article that "despite the decline in public trust in science from a recent peak in the earlier stages of COVID-19, this is still far higher than the confidence reported in the government, the president and the media".

France is not unique in displaying a rapid increase followed by something of a decrease in public trust in science, in that there has been similar press in Belgium, Germany and the UK in June 2020.

Overall, the literature suggests that there has been increased trust in science during the pandemic, but a question mark remains regarding the sustainability of this shift in public opinion, given wider societal trends towards mistrust of expertise and science.

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[102] Shepherd, Marshall. 2020. "Coronavirus Pandemic Highlights the Importance of Scientific Expertise." Forbes (14 March) Available at: https://www.forbes.com/sites/marshallshepherd/2020/03/14/covid-19-andthe-sudden-respect-of-science-expertise/54ae1afa29b0

[103] Revenge of the experts: Will COVID-19 renew or diminish trust in science? Authors: Cevat Giray Aksoy, Barry Eichengreen, Orkun Saka, Quantitative Political Economy Research Group, Department of Political Economy, King's College London 31 May 2020. See https://voxeu.org/article/will-covid-19-renew-or-diminish-trust-science and https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3613554

[104] Public trust in science soars following the pandemic, David Matthews, May 7th, 2020 https://www.timeshighereducation.com/news/public-trust-science-soars-following-pandemic

[105] Idem.

[106] https://www.timeshighereducation.com/news/public-trust-science-soars-following-pandemic

[107]Science risks coronavirus backlash as it's drawn into politics. https://www.timeshighereducation.com/news/science-riskscoronavirus-backlash-it-drawn-politics

[108] David Matthews, 8th June, 2020: https://www.timeshighereducation.com/news/french-trust-science-drops-coronavirus-backlash-begins

Public mistrust in scientific facts, combined with a misunderstanding of how science works (i.e., that scientific results are not necessarily certain), risks fundamentally undermining universities, as it questions the value of the scientific method that is inherent not just to their research activities, but to the educational, teaching and learning processes. Universities' research activities provide an opportunity to maintain and strengthen public trust in research generally, and in university research in particular. A holistic approach will be needed, which:

- Continues to focus on excellent science as producing scientific research results that are robust and stress quality over quantity should in itself help to engender trust in the research produced by universities (this is the argument put forward by some university networks that "the science should do the talking");
- Encourages active engagement in communication activities and continued engagement with different sectors, with EU citizens and society as a whole; and
- Continuing and expanding external co-operation with non-academic sectors.

The above challenges are mainly external. However, there is also a vitally-important internal dimension where universities can play a role, namely ensuring the highest standards of research integrity and scientific ethics are maintained. These are covered in detail in the following sub-TM.

Although some literature points to closer citizen and societal engagement in science as among the success factors contributing to fostering trust in universities, not all stakeholders and university networks taking part in this study's consultation process agreed. Some counter-argued that having to involve citizens in science could jeopardise the paramount focus on achieving quality in science, which is central to maintaining trust. However, this is a question of balance, as some stakeholders supported maintaining closer proximity to the public. During the consultation process, the Guild advocated that "science should be frontier-led: only scientists know where the frontiers of science are right now, which cannot be determined by citizens. However, this does not mean that you cannot have citizens' involvement where appropriate".

The rapid pace of technological advancement means there is a risk that policy and ethical frameworks do not keep pace, particularly if such risks are not clearly or widely understood.

There are differing stakeholder views as to what trust actually means and how it should be defined. It is therefore important to determine how to define trust in relation to universities and academia more broadly. Public trust is defined as follows by Funk (2017): ''Public trust in scientists encompasses expectations about scientists' actions, trust in scientists to be honest brokers of information, trust in scientific expertise and understanding, and trust in the motivations and influences operating on science research''[109]. Three key elements emerge from the definition offered by Funk, namely the **role of science and scientists**, **levels of confidence and understanding in science** and the **vested interests in scientific research.** These three points are indeed recurrent themes in the literature and are explored in this TM.

Whilst universities are generally trusted, and their research mission is widely appreciated, stakeholders taking part in the first workshop pointed to ongoing challenge regarding maintaining public trust. Accordingly, maintaining trust has been included as a module.

[109] Funk, C. (2017). Mixed messages about public trust in science. *Issues in Science and Technology*, *34*(1), 88.

The Academic Cooperation Association (ACA) notes several emerging challenges relevant to this TM, from rising populism and xenophobia to mistrust in science and academia[110]. Therefore, in light of the rise of populism and the rejection of expert knowledge, universities will need to preserve the levels of public trust they currently enjoy, and try to build on this in the coming decade. Exactly how this will be accomplished will vary across different universities, depending on a myriad of factors, including its location (city/ urban, more rural university), the prevailing political climate in a given Member State, and country's media and social media attitudes regarding scientific outputs produced by research performing actors, with universities at the forefront, and how this in turn influences EU citizens' perceptions. Universities need to be part of the solution to such societal problems, but they can only be expected to constitute a small part of the solution given the complex web of factors that influence public trust in science and research, the majority of which are outside universities' control.

Indeed, the factors influencing trust in universities vary widely, depending on different stakeholder perspectives. For instance, in a research publication on trust in universities, it is suggested that "without a high degree of 'trust', universities' capacity to fulfil their critical and speculative functions will be eroded. The growth of mass higher education systems, the managerial revolution within institutions, the development of a market culture (and behaviours), the emphasis on professional training and vocational outcomes and the advance of the 'knowledge society' focused on the impact of research – all pose serious threats to traditional notions of 'trust' in higher education".[111] However, there are some difficulties in arriving at a common understanding of what trust means in a university context in Europe, as different stakeholders have differing interpretations. Elsewhere in the policy report, the TMs proposed advocate strengthening managerial input in some areas so as to enable areas such as Open Science, career management, professional training and vocational outcomes.

One means of ensuring that trust is maintained in universities is to ensure continued adequate government funding for universities, with appropriate funding earmarked towards fulfilling their crucial research mission. Yet many of the university networks have pointed to the need for increased funding of higher education generally in order to support the research function. For instance, a CESAER position paper on *Sustainable Funding for Universities of the Future in Europe* points out that funding levels for universities across much of Europe have been dropping over the last decade. "Many institutions have seen their direct (block) funding streams become smaller and smaller, and have been forced to rely more and more on short-term competitive funding streams, increasing the pressure on these instruments and decreasing success rates to levels considered unacceptable. These developments are in stark contrast to the bold ambitions expressed in and around Europe. To lead the way in tackling our global challenges, universities play a key role as the engines behind higher education and as foundations for excellent research and innovation".[112]

It is also worth drawing attention to the recent EUA briefing on the impact of the COVID-19 crisis on university funding in Europe, as this incorporates lessons learned from the 2008 global financial crisis[113]. The briefing points out for example that "all sources of

[110] ACA. (2019). Towards a 2030 Vision on the future of universities in Europe. Available at: http://www.acasecretariat.be/fileadmin/aca_docs/event_presentations/Towards_a_2030_Vision_on_the_Future_of_Universities_in_Europe.pdf

[111] Engwall, L. and Scott, P. (2013). *Trust In Universities*. Portland Press. – Available at: https://portlandpress.com/pages/volume_86_trust_in_universities_

[112] CESAER, Position Paper, Sustainable Funding for Universities of the Future in Europe, 16 March, 2020. Available at: https://www.cesaer.org/content/5-operations/2020/20200316-adopted-position-sustainable-funding.pdf

[113] EUA briefing on the impact of the Covid-19 crisis on university funding in Europe: lessons learned from the 2008 global financial crisis, May 2020, Authors: Thomas Estermann, Enora Bennetot Pruvot, Veronika Kupriyanova and Hristiyana Stoyanova: https://www.eua.eu/resources/publications/927:the-impact-of-the-covid-19-crisis-on-university-funding-in-europe.html

university income will be affected in some way in the short to medium term". It also mentions that "Competition for EU funds allocated under Horizon Europe and Erasmus+ is likely to grow in the coming years. Universities will struggle to increase or even sustain the income from this source to support transnational research and education projects". The paper also notes "public authorities may renew their interest in mergers". This is relevant to TM1, which discusses the possibility of mergers of universities and the legal difficulties in doing so and how these might be overcome at a transnational level.

A different issue from the question as to whether citizens trust universities is whether governments trust universities and the scientific results they produce. Universities might either lose funding or might be distrusted by governments because the key messages from their scientific research are not necessarily what governments want to hear or act upon. A recent example arose during the COVID-19 crisis, where at different points during the crisis and in different EU countries, politicians' and scientists' statements regarding optimal means of protecting the public and reducing the spread of the virus have sometimes been aligned, but on other occasions diverged. There are further examples of government mistrust of universities that extend beyond the present crisis in particular countries. This is clearly a difficult issue, especially if governments try to politicise university research outputs. However, this problem could be addressed by adhering to the fundamental principles of universities' autonomy and the academic freedom of researchers along with a continued focus on excellent science.

What these different viewpoints on trust in universities is demonstrate is that whilst trust is important for all universities in fulfilling their research mission, there are many different views as to the extent to which there is trust in universities and research they produced, or conversely an erosion of trust, and as to how trust might best be maintained in future. Given wider societal challenges around public trust in expertise and in science and research, this issue is one that universities need to remain aware of between now and 2030. The issue also implies ever-closer public engagement and strengthened communications activities. The latter two issues are addressed in TM5 (public engagement and communications, and the utility of citizen science).

4.3.1.2 Challenges

Challenge 1: Maintain public trust in research and science undertaken by research performing actors, including universities

Research by the EU's Joint Research Centre (JRC)[114] found that the authority of scientific evidence to resolve political debates is being challenged at the same time as the role of traditional information 'gatekeepers' is being weakened. The JRC goes on to note that trustworthiness is not only about the competence or excellence of science but is also dependent on the honesty of a source of information. Evidently, this is an issue which extends to public institutions generally, not only universities or research performing actors.

One of the key challenges for the future of universities in Europe will be to strengthen their engagement with other sectors (e.g. with industry, the non-profit sector actors) with civil society and with citizens. Building societal and citizen trust in expertise and in research carried out using the scientific method is the responsibility of many different actors, ranging from government, to the whole education sector not only tertiary education. As universities are central actors within regional and city-based ecosystems, they have an important role to play in this regard. The JRC concludes that there is a need for trust to

[114] European Commission Joint Research Centre. (2019). *Understanding our political nature: How to put knowledge and reason at the heart of political decision-making.* Brussels. Available at: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/understanding-our-political-nature-how-put-knowledge-and-reason-heart-political-decision

be (re-)built through the development of shared interests (e.g. between scientists and the audiences for their results), a recognition that science is not value-free, balancing risk and uncertainty, and opening evidence to public scrutiny.

Currently, there appear to be positive attitudes towards research and science in general among EU citizens.[115] Recent polls in Germany, for instance, indicate that most German citizens believe that science is best equipped to tackle contemporary and future challenges faced by society as a whole.[116] However, there is a lack of reliable quantitative data on the extent of trust in universities. The reliability of the results of some survey-based studies has been widely questioned.[117]

Certain technologies suffer from a significant amount of mistrust from the public. Examples of such technologies include but are not limited to; fracking, mobile phone masts, high tension electricity pylons, GMOs, wind turbines and nuclear energy.[118] Ensuring more transparency as well as disseminating clear information as how the risks associated with these technologies can be mitigated is crucial. However, it is important to note that new means of communication will need to be adopted, particularly digital forms.

Lastly, enhancing societal trust in science is a challenge which isn't the responsibility of universities, but rather a shared challenge for government, politicians, and research-performing actors at all levels, including universities.

Challenge 2: Strengthen the understanding and interpretation of scientific evidence and research results by policy-makers and wider societal actors, and scientific literacy among citizens.

Maintaining and strengthening public trust in publicly-funded research – including research conducted by universities – requires a concerted effort across the policy-making and societal landscape. It is about communicating the results more effectively to relevant EU, national, regional and local policy-makers and to citizens, pursuing open science, open access and open data policies (see TM6) to maximise the visibility of results, it is also concerned with ensuring that policy-makers are more responsive to science and to research outcomes.

Strengthening trust, as is made clear in the JRC report (mentioned under Challenge 1), is bi-directional. "The increasing complexity of policy problems and the abundance as well as ambiguity of scientific knowledge poses a significant 'technocrat's dilemma'. Relevant, synthesised, expert advice is increasingly needed but the authority of such experts is being challenged. There are also extensive barriers to the use of evidence by policymaker […] The gap between the needs of policymakers and the ways researchers present evidence is one of the key barriers for the injection of evidence into policy-making".[119]

Policy makers need to be better equipped to help extract policy-relevant materials from published scientific reports and research. This would then in turn enable policy makers to communicate how they have used publicly-funded scientific and research results, in a way

[115] Eurobarometer. (2014). *Special Eurobarometer 419: Public Perceptions of Science, Research and Innovation*. Available at: https://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs_419_en.pdf
[116] Wissenschaft. (2018) *Wissenschaftbarometer 2018.* [online] Available at: https://www.wissenschaft-im-dialog.de/projekte/wissenschaftsbarometer/wissenschaftsbarometer-2018/
[117] Myklebust, J. P. (2018). Half of the public does not trust research – Survey. Available at: http://www.universityworldnews.com/article.php?story=20170930043900131
[118] Science Foundation Ireland. (2015). *Science in Ireland Barometer*. Available at: https://www.sfi.ie/resources/SFI-Science-in-Ireland-Barometer.pdf
[119] European Commission Joint Research Centre. (2019). *Understanding our political nature: How to put knowledge and reason at the heart of political decision-making.* Brussels. Available at: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/understanding-our-political-nature-how-put-knowledge-and-reason-heart-political-decision

that reinforces trust among citizens more widely, who are unlikely to read many research papers themselves, unless they have interests in specific areas.

In an evaluation of three years of the ERCEA's operations, the executive agency which supports the Scientific Council in implementing the ERC grants scheme, it was found that the ERCEA provides many inputs to policy making, and provides support to members of the Scientific Council. The Council publicises key achievements when taking part in conferences and events to promote achievements across groups of ERC research projects in particular thematic areas (e.g. climate change, artificial intelligence).[120] However, attendance by policymakers at these events was variable. Moreover, the level of uptake of ERCEA policy outputs produced in terms of usage by policymakers was unclear, as there was no data available.

Greater engagement with the public has been posited as a means of maintaining trust, however, this should not only be limited to the involvement of EU citizens in academia. A clearer understanding on the part of EU citizens, scientists and politicians as regards the roles that science, EU and national policymakers and researchers should play in our societies is needed. This may be understood as "science-society literacy". Additionally, scientific literacy, the understanding of the fundamentals of science as they pertain to its methodology, observations, and theories—remains an issue. Better communication regarding what, realistically, science can and cannot achieve is also required as some surveys have revealed significant gaps in scientific literacy.[121]

Whilst recognising the considerable work by some universities in the area of communications of scientific and research activities, there was a recognition that universities as a whole faced increased pressure to engage even more actively in communications activities, including to address the challenges linked to increased secular scepticism of expertise.

Some, but not all, of the university networks, supported the proposition that communication activities are likely to be increasingly crucial in the next decade. For instance, written feedback from the YERUN network commented "in order for universities to more realistically present themselves, and the research they produce to citizens and society in general, they need to work more with mainstream media to promote their work internationally and nationally. Universities also need to focus on work that directly benefits local communities. Science communication to the target group society must be trained and should be rewarded".

Challenge 3: Maintain trust in research and science, and ensure autonomy in light of rise of populism.

Issues relating to populism, concomitant scepticism, and sometimes complete rejection of expert knowledge, have not been as virulent across the EU as a whole as they have been in the United States.[122] However, this masks variations within the EU. For example, in Hungary, certain topics in SSH have come under government criticism to the extent that

[120] Evaluation of three years of the operations of the ERCEA, 2015-2018. Evaluation for the European Commission's DG RTD.
[121] In a study (DG IPOL 2019) presented to the CULT committee of the EU parliament, scientific literacy within the EU public was found to be unevenly distributed. The need to achieve a more even distribution as well as higher scores overall was particularly emphasised.
[122] Numerous surveys carried out in the US have revealed a rise in scepticism towards science. However, studies in the EU have not documented such trend and have on the contrary revealed steady positive attitudes regarding science.

gender studies were banned in 2018. [123] There has also been interference in the subject of history.[124]

There remains room for improvement to combat growing distrust in science and research.[125]

There is also evidence of government interference that compromises the fundamental values set out in the Vision around the importance of the autonomy of universities and academic freedom of researchers. Interestingly, researchers' activities are seldom rewarded on the basis of their contribution to building public trust. Researchers should therefore be offered more incentives to consider public trust as an integral part of their research activities. Indeed, Calhoun (2006) noted that academics too often "treat opportunities to do research not as a public trust but as a reward for success in past studies".[126]

Challenge 4: Reflecting upon the potential ethical challenges of working closely with industry and business (e.g. industry sponsorship of research, the commercialisation of research, contract research).

University-industry collaboration is examined under TM5 (cooperation with other sectors). In many EU Member States, there is a long tradition of cooperation, and this creates strategic benefits for universities institutionally (e.g. additional funding source, developing destinations for graduate and research talents), as well as career development benefits for the individual researchers concerned.

However, when universities develop close relationships with industry, this raises a number of issues, for instance, objectivity may be compromised, questions of ethics could be raised, and the university may be beholden to companies' interests. Ethical issues could arise from collaboration with particular sectors (e.g. pharmaceuticals, telecommunications, among others), or specific companies, as well as potential conflicts of interest.

There are general societal concerns around the ability of big business to influence research across different sectors. Some research papers have also addressed this topic, and have investigated considerations regarding industry sponsorship of research and the extent of its influence on research agendas. A study in the U.S. found that "corporate interests can drive research agendas away from questions that are the most relevant for public health. Strategies to counteract corporate influence on the research agenda are needed, including heightened disclosure of funding sources and conflicts of interest in published articles to allow an assessment of commercial biases".[127] Given the scale of funding by U.S. industry, it is arguable that this is a greater problem in the U.S. than in Europe, but it is nonetheless an important consideration for the EU-27 too.

Usually universities promote strongly their commercialisation activities especially to government to show how they are exploiting public investment in research. There is an

[123] Oppenheim, M. (2018). Hungarian Prime Minister Viktor Orban bans gender studies programmes. The Independent. 24 October 2018. Available at: https://www.independent.co.uk/news/world/europe/hungary-bans-gender-studies-programmes-viktor-orban-central-european-university-budapest-a8599796.html
[124] Hungarian Spectrum (2019). Orban movies against historical research, the first victim is the 56 institute. https://hungarianspectrum.org/2019/06/02/orban-moves-against-historical-research-the-first-victim-is-the-56-institute/. [Accessed 18 June 2020]
[125] Jean-Pierre Bourguignon, former president of the ERC, is one of those observers. In a speech delivered in 2019 he pointed out the growing discontent and rejection of expert knowledge by certain segments of society. He underscored the necessity to better communicate with the civil society about what the remit of science is.
[126] Calhoun, C. (2006). The University and the Public Good. *Thesis Eleven*, 84(7), 7–43
[127] Fabbri, A., Lai, A., Grundy, Q. and Bero, L.A., 2018. The influence of industry sponsorship on the research agenda: a scoping review. American journal of public health, 108(11), pp.e9-e16. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6187765/

issue however related to where academics can be diverted from core research by being pressured to take on commercial activities in order to improve institution metrics.

Whilst the entrepreneurial university model has many positive attributes, this area of activity within universities' R&I mission needs to be carefully managed as it can affect the public's perceptions of universities and their role.[128]

Whilst not all universities engage in entrepreneurial activities, those that do will need to ensure that the commercialisation of research (and equally, contract research) is carried out in a way that takes ethical considerations into account. This may also require universities to engage in social dialogue with other sectors and with civil society regarding their relationship with industry and business, when particular concerns are raised.

Improved communication regarding universities' relationship with industry may in certain circumstances be needed as to the reasons why commercialisation of data output is not a drawback. This can in fact be complimentary to non-profit activities in which universities need to engage.

Challenge 5: The need for scientific evidence within shorter timeframes, and the risks associated with accelerated peer review.

The evolving COVID-19 pandemic has created an urgent need for scientific evidence. Decision-makers need to be able to make informed decisions quickly and support the development of effective vaccines and treatments. While the speed with which the global scientific community has risen to this sudden pressing and unprecedented need is remarkable, the has in some instances come at the cost of ensuring that essential safeguards for scientific reliability are respected such as peer-review. As a result, there has been an important increase in the use of pre-print servers, where scientists can post manuscripts before undergoing peer review. These studies are not always clearly reported as such by media outlets, and readers should treat the findings as preliminary.

In addition, the abundance of COVID-19 research is also reshaping peer review at journals. Several titles, including Science, journals published by Cell Press, The BMJ and Nature report a surge in COVID-19-related submissions, and many have accelerated the peer-review process to ensure rapid dissemination. A preprint posted in April on bioRxiv2 found that many medical-research journals had drastically speeded up publication pipelines for COVID-19 papers. The analysis, which included 14 journals, found that average turnaround times had fallen from 117 to 60 days[129.]

It is crucial for researchers to maintain high levels of quality of their research outputs particularly in an age of uncertainty. Scientists should clearly communicate to the public the limits on their research results especially when their studies have not been peer-reviewed and/or their results not been reproduced.

Overall, peer review therefore needs to be maintained as a fundamental part of the quality review of academic research prior to papers being published. However, explained under TM6 on Open Science, there is scope for innovative means of peer review, such as increased use of open peer review processes, as current peer review processes are at their limits (even with longer time spans). Therefore, openness is arguably the optimal way to strengthen the quality of final research outputs, and to find and correct any mistakes.

[128] Molesworth, M., Scullion, R., & Nixon, E. (Eds.). (2010). *The marketisation of higher education*. Routledge.
[129] Kwon, D. (2020). 'How swamped preprint servers are blocking bad coronavirus research'. *Nature.* 07 May 2020. [Accessed 22 June 2020]. Available at: https://www.nature.com/articles/d41586-020-01394-6.

4.3.1.3 Transformation needs

By 2030, universities should continue to be trusted as generators and disseminators of knowledge. They should engage even more closely with other sectors (see TM5), and strengthen their communication function regarding the dissemination of scientific and research outputs to improve awareness of their societal and economic relevance.

In a post-truth society[130], where necessary, universities should help to counter disinformation and misinformation regarding the (mis)interpretation of scientific and research results, including by politicians and social media users. They can accomplish this by strengthening their communication and dissemination activities, and where necessary, refuting deliberate disinformation and misinterpretations of scientific and research results. This could be as simple as providing a response pointing to robust scientific research when sensationalist stories gain major currency that refute scientific evidence. This is not to suggest that universities should respond to all fake news and disinformation about academic research; rather, they should provide an authoritative response to the worst instances of distortion of scientific evidence, such as where public health could be at risk (e.g. anti-vaccination movements).

Maintaining trust is partly about enabling universities to continue to do what they do best, i.e. focus on excellent science, including frontier-led, fundamental research, as well as more applied types of research and mission-driven research where appropriate. However, the lack of awareness (and scale of ignorance among many citizens) of the value of scientific methods in an era of fake news, and distortion of research results to suit political needs, are problems that demand a more proactive approach by universities in Europe regarding strengthening their communications and dissemination function. Drawing attention to scientific research results of interest and relevance to citizens, and occasionally stepping into refute disinformation could have an important impact in maintaining public trust. Whilst this is a shared responsibility with governments, public institutions and traditional media sources, universities are uniquely placed, as they are rooted in local communities and cities, and can use this position to combat any disinformation that threatens their credibility.

As part of their mission to put knowledge to the service of society, universities can potentially play a valuable role as anchors within innovation and urban ecosystems to help overcome the challenges linked to citizens distrusting experts and science. This can be achieved through a continued commitment to delivering on their core missions relating to teaching and learning, scholarship and engaging in world-class research, and collaboration with an even wider range of societal actors, and outreach and proactive communication of scientific results, and their societal relevance.

Accordingly, universities need to engage proactively and energetically with the communities in which they are operating. This is not to suggest that universities are the problem. On the contrary, as respected institutions locally and regionally, they are part of the solution, as trust in scientific research has been increasingly questioned in an era of disinformation and social media.

University networks, such as The Guild, have pointed to the fact that universities are best placed to sustain trust in public institutions, as per the following quote from their yet-to-be published report on the Future of Universities in Europe: "Universities have a unique ability, and an utmost responsibility, to be institutions of evidence-seeking where

[130] Scientific communication in a post-truth society, Shanto Iyengar and Douglas S. Massey, PNAS April 16, 2019 116 (16) 7656-7661; first published November 26, 2018 https://www.pnas.org/content/116/16/7656 , Edited by Dietram A. Scheufele, University of Wisconsin-Madison

scholarship and discussion is distinguished by rational argument, judgement, reason, and responsibility, actively challenging the culture of 'post-truth' in all its forms."[131]

The majority of universities already engage with a diverse spectrum of stakeholders, including societal actors and citizens (see TM5 on relationships with other sectors). However, even more intensive engagement will be needed between now and 2030.

In an age when the boundaries between information and misinformation are more porous than ever, universities have a civic duty to instil in their students and researchers as well as their surrounding local communities' key attributes of intellectual curiosity, a respect for knowledge and a capacity for analysis, and constructive scepticism and questioning about what is presented as information. Universities also need to teach about the unpredictability of science, and the fact scientific evidence isn't static, but evolves as further research is conducted and peer reviewed. This is a consideration that many citizens and politicians presently appear to be unaware of.

The role of tertiary education attainment in building public trust in scientific research, and in maintaining trust in universities should be recognised. There is evidence to suggest that better educated EU citizens hold more positive views towards research and academia at large. As Busemeyer and Garritzmann (2017) conclude ''the higher individuals' education, the more likely they are to support investments in education''.[132]

It is important to note that communication between universities and the public should not be perceived as a one-dimensional process. Any communication involves a communicator, an audience, and channels of communication that are often bidirectional, all situated in a particular social context.

Envisioning "science communication" solely as a scientist delivering information to another individual about a scientific topic would be inadequate. Most science communication is more dynamic and takes place in a complex context involving individuals, groups, and organisations that are both the communicators of, and audiences for science. It is therefore essential to consider science communication as a two-way process wherein both researchers and other actors engage.[133] These principles should be reflected in how universities engage in societal dialogues with civil society, the wider public, and also with policymakers at local, regional, national and European levels.

4.3.1.4 Case studies

The following cases illustrate how universities already engage in activities intended to improve public trust in science.

The first example seeks to improve scientific literacy among the public. The second example involves academic research regarding means of strengthening public understanding of science.

Strasbourg University: campaign against ''idée reçue'' (received idea)

Objective: Increase scientific literacy among the public in order to better equip citizens to spot fake news.

Description: From 2017 to 2019, the French University of Strasbourg (Unistra) in partnership with Rue 89 (a local newspaper) held a series of public lectures intended to address the rise of

[131] Guild Vision for the Universities of the Future – Draft 29 March 2020 (unpublished manuscript)
[132] Busemeyer, M.R. and Garritzmann, J.L. (2017) Public opinion on policy and budgetary trade-offs in European welfare states: evidence from a new comparative survey, *Journal of European Public Policy*, 24:6, 871-889.
[133] Trench, B. (2008). Towards an analytical framework of science communication models. *Communicating science in social contexts*. pp. 119-135.

Strasbourg University: campaign against ''idée reçue'' (received idea)

so-called fake news. This initiative was led by 2 academics: Philippe Gillig from the Bureau of Theoretical and Applied Economics (BETA) and Fleur Laronze, a legal scholar. 14 public lectures were delivered by the initiative and were aimed at popularising intricate scientific topics without, however, succumbing to oversimplification as is often the case with populism. The targeted audiences were populations living away from the city centre as well as individual living in rural areas, who oftentimes lack access to universities and the knowledge they produce.

Key achievements/lesson learned: This example illustrates how EU universities can set up initiatives to curb the rise of scepticism towards science. Indeed, by taking on an active role the universities of the future will contribute to the dissemination of a better understanding of complex scientific phenomena among the public. In addition, this universality-led initiative demonstrated that universities can have a broader outreach when they establish partnerships with other local organisations.

Replicability/transferability potential: Similar initiatives have been documented in other EU universities. For instance, the University of Heidelberg in Germany has launched in 2018 a guest professorship for science communication. Similar to Unistra's campaign, the professorship is joint initiative between the Holtzbrinck Publishing Group and the Klaus Tschira Foundation (KTS). The professorship held a number of conferences some of which were aimed at tackling the rise of fake news. Although it would be unrealistic to expect every EU university to replicate such initiatives, partnerships between universities and other organisations to address these issues would be suitable.

The following example regards a professorship funded by a charitable donation. However, for many universities in Europe, a question would arise whether such a professorship should be financed from core funding.

Oxford University - Establishment of a professorship for the public understanding of science (Simonyi Professorship)[134]

Background: First established by the British ethologist Richard Dawkins, in 1995, the Professorship was created with the help of an endowment by Dr Charles Simony. At its inception, the professorship was designed with the ambition to make important contributions to the public understanding of science rather than study the public's perception of the same.

Purpose of case study: Illustrate a university-based initiative to engage with local communities.

Objectives: Increasing scientific literacy among the public. Engaging in and fostering wide-reaching societal dialogues with a variety of actors.

Description: The current holder of the professorship, Marcus Du Sautoy, in interested in communicating science to the public without losing those elements of scholarship which constitute the essence of true understanding. That is to say, the various activities put in place by the appointee have been devoted to popularising science to the public while not falling into the trap of oversimplification. Clearly articulating the limits of current scientific knowledge to the public is one aspect that Dr Du Sautoy stresses.

Regarding the activities produced by the professorship, various publications have been released over the years. In addition, the professorship has been collaborating with a wide range of external partners such as Pattern Foundry and the centre for Practice and Research in Science and Music based at the Royal Northern College of Music in the UK.

Key achievements: Making science more accessible, training university academics and researchers in how to engage with the public on scientific issues in an accessible yet factual manner. Engaging in dialogues with cross-sectoral actors.

Good practices: One of the key good practices is the communications strategy developed by the professorship. In order to communicate scientific ideas effectively to the public, a variety of media are utilised in order to reach as wide a range of people as possible. These include, but are not

[134] Information provided on the Simonyi Professorship's homepage: https://www.simonyi.ox.ac.uk/.

Oxford University - Establishment of a professorship for the public understanding of science (Simonyi Professorship)[134]

limited to, public lectures, writing articles and books, and television as well as radio appearances.

Lessons learned/transferability: This initiative exhibits limited transferability to other smaller institutions as its associated costs are quite significant (the professorship is funded by a Charles Simonyi, a Hungarian-American philanthropist). However, as regards good practices, there are a few lessons to be taken away notably its digital media strategy and embedded collaborative approach to the popularisation of science and research.

4.3.1.5 Possible actions

A number of possible actions that the EU and Member States could undertake to maintain public trust in science and research are now outlined. These could help to strengthen the proximity between universities and EU citizens:

EU level:

- The European Commission should commit to evidence-based policy-making and using scientific research results and impacts in their actions wherever possible, and ensure that this is demonstrated in technical work to accompany Commission Communications (e.g. in Staff Working Documents).
- An effort could be made to collect good practices regarding initiatives by universities to help maintain public trust, and to communicate scientific research results effectively to different stakeholder audiences (e.g. to policy-makers, and more technical audiences, and to civil society and citizens, where simpler messaging is needed).
- The EU should continue to fund Science Day events, as these have been effective in engaging with EU citizens (not all existing initiatives are university-focused). Funding for more university-based civic engagement and citizen engagement in science initiatives could be provided.
- An EU funded initiative could be set up to allow universities to apply for funding to organise events to foster social dialogue between universities, policy-makers, industries and civil society on issues connected with maintaining public trust in science and research.
- Encouraging collaboration between universities and other civil society actors to address scientific literacy deficits among the general public and within academia. As it has been exemplified in the success stories presented above, similar initiatives should be implemented. Appropriate funding schemes could be put in place to support such initiatives. These potential schemes will need to be implemented at EU level, but Member States should be encouraged to promote similar events.
- The EU code of practice on disinformation is managed by DG CONNECT. The stakeholders taking part in this initiative could be expanded to include the active targeting of universities to join in the initiative, to give it greater visibility, and to reinforce European values in this area.

Member State level:

- Grant schemes could be established to encourage universities to undertake further communication and dissemination activities regarding their scientific research activities and results.

University level:

- Issues around potential conflicts of interest and objectivity questions arising from cooperation with industry could be dealt with by ensuring that clear declarations of

interest are made in all publications both academic (now required by most journals) and public. This is also where the European Codes for Ethics and Research Integrity can play a positive role.

- Science Day type events are one of the ways in which universities can engage with the public to showcase the relevance of scientific research and research results, and its contribution to society.
- Civic engagement could be included as a formal aspect of universities' performance. Indicators could attest to the level of engagement, such as the number of public seminars held.
- Universities should continue to play a key role in engaging through societal dialogue with civil society actors about the social impacts of science and technology. This is currently well-developed in Denmark, partially in France and the UK, but under-developed elsewhere in the EU-27.
- Universities should be encouraged to harness the power of local and regional media, as well as social media to promote their values, such as the importance of the scientific method and rigour in research, the imperative of ethical behaviour, tolerance and inclusivity and take those arguments into the public arena.
- As regards combatting disinformation and fake news, more universities could sign up to the EU code of practice on disinformation.

4.3.2 TM2.2 - Research integrity and scientific ethics.

4.3.2.1 Introduction

The degree of attention to research integrity and scientific ethics has grown in the past 5-10 years, driven by various factors, such as: growing pressure from research funders that researchers document how they have addressed scientific ethics when conducting research. There are also broader societal demands for publicly-funded research to be undertaken in a way that respects ethical principles and interest among the public (e.g. respect for human rights, environmental considerations). For instance, Horizon 2020 includes funding for ethics under the SwafS (Science with and for Society) calls and ethics reviews were introduced in FP7.[135]

Moreover, universities, in common with other research actors, have to operate within a stricter regulatory environment than in the past, in particular as regards the GDPR (General Data Protection Regulation), which has implications for data collection and analysis during research projects, especially in SSH (social sciences and humanities). However, concurrent initiatives that seek to foster training and awareness building are also paramount in changing cultures. There may be scope to increase the provision of funding dedicated to initiatives to train staff (this is also referenced in TM4 human capital and TM6 open science (under skills for open science), maintain public trust, spread good practice and new approaches as well as reinforce a culture of integrity and ethics amongst academics and researchers. EU initiatives can also increase understanding of current challenges (e.g. through studies or expert panels) and disseminate such understanding.

4.3.2.2 Challenges

Challenge 1: Keeping pace with new technological developments and the ethical concerns that they pose.

Fast technological developments need to be accompanied by ethical amendments and revisions. Research areas that are particularly vulnerable to ethical hazards and violations include research on **Humans** (STEM cells as well as any other human cells/tissues), **protection of personal data**, **animals**, **environmental protection and safety** and

[135] See https://ec.europa.eu/programmes/horizon2020/en/h2020-section/ethics

research with non-EU countries (**international research**). In addition, **AI and nanotechnologies** are additional scientific and technological fields that have the potential to bring about technological breakthroughs that could result in consequential societal upheavals. These areas are therefore to be monitored closely and common legislative as well as policy frameworks must be developed with the participation of all key stakeholders. Participation is particularly important in order to include all concerned parties and render the process as inclusive as possible. Indeed, it is essential to favour approaches to ethics and integrity that are not only coercive in nature but also participative to ensure that relevant stakeholders gain ownership of ethics by pursuing self-regulatory approaches.

Challenge 2: Establishing a common ethics assessment framework across a variety of disciplines

While it is common for universities to include research ethics or at least research integrity-related provisions in their general codes of conduct, the scope of ethical issues tackled by ethical assessment and guidelines depends on the spectrum of scientific disciplines covered by an ethics committee. Consequently, few university Research Ethics Committee (REC) follow a specific universal set of principles. These are rather dependent on discipline-specific standards as well as the general state of ethics assessment in a particular country. Moreover, there is different national legislation as regards areas such as stem cell research and novel food research, which means that ethical issues in scientific research may be viewed differently, and require a differentiated risk assessment, depending on the prevailing legislation where the university is based.

Universities and university associations trying to establish a common ethics assessment framework across a variety of fields may face difficulties due to the differences between disciplines in relation to the same ethical issue or principle. This is why many universities establish different ethics assessment protocols in different faculties. Calls have been made to establish an international ethics framework for universities, e.g. by IAU.[136]

Challenge 3: Addressing the gaps in ethics regulation across Member States

As each Member State retains its full prerogative to legislate on ethical matters, sizeable gaps in legislation exist between Member States. For instance, although the situation has evolved since 2015, a research paper on ethics focusing on central and eastern Europe identified a number of gaps in research ethics policies in some countries, such as Latvia, Lithuania and Poland.[137] Therefore, one of the challenges for Europe 2030 will be to work towards stronger harmonisation of national ethics regulatory frameworks focusing on the Member States where deficiencies are the most important.

4.3.2.3 Transformation needs

By 2030, universities in Europe will practice the highest possible standards of research integrity and scientific ethics. They will be trusted partners of government, industry and other non-academic sectors. Citizens will be able to trust universities and the results of universities' research on the basis of universities' integrity, ethics, expertise and autonomy. Characteristics of Europe's university sector will be:

- Adherence to, and compliance with ethical principles that protect the dignity, rights and welfare of research staff, participants and others affected by research;
- Sensitivity to local, national and global concerns around research integrity and scientific ethics by pursuing means to create more proximity at all levels;
- Encourage committed leadership of universities in responding adequately to breaches

[136] Satori. (2015). *Ethics assessment and guidance in different types of organisations: universities*.
[137] Famenka, A. (2016). Research Ethics in the Context of Transition: Gaps in Policies and Programs on the Protection of Research Participants in the Selected Countries of Central and Eastern Europe. *Science and engineering ethics*, 22(6), 1689–1706.

of research integrity and research ethics;

- Staff with the necessary knowledge and commitment to research integrity and scientific ethics;
- Clear and consistent communication to stakeholders, media and citizens on issues of integrity and ethics, particularly on sensitive issues;
- Ethical awareness should be raised and efforts made by universities not to reduce ethics to its restrictive dimension and less its administrative burden.
- Cross-disciplinary ethical framework should be developed in order to achieve more consistency across university departments.
- National and EU regulatory frameworks should continue to be harmonised. The EU could serve as a leading global actor in harmonising research ethics.

4.3.2.4 Success stories

The following example focuses on the European Research Council (ERC) grants scheme, where universities play an important role as the host institutions for successful ERC grantees.

Scientific ethics and research integrity in the ERC grants scheme and the Ethics Appraisal Procedure in Horizon 2020

Background: The European Research Council (ERC) supports frontier research in a pan-European and international competitive research environment in which grants are awarded on the basis of scientific excellence as the sole selection criterion. The ERC grants scheme is relevant to universities' capacity as host institutions for portable ERC grants held by individual researchers. The scheme is implemented through the ERC Executive Agency (the ERCEA), overseen by the Scientific Council.

Purpose of case study: To demonstrate the advantages of embedding scientific ethics and research integrity in managing research funding programmes and monitoring research projects. From a researcher perspective, the aim is to show the importance of documentation ethical considerations in planning and carrying out research projects to ensure there is a clear audit trail that shows how ethical issues have been considered (e.g. by principal investigators).

Objectives: Maintain research integrity and scientific ethics in the ERC grants scheme (overall at programme level, in individual research projects).

Description: The ERCEA administers the ERC grants scheme on behalf of the Scientific Council. It seeks to maintain the scientific community's and society's trust by upholding ethical standards at all stages in the competitive process, and by maintaining and promoting a culture of research integrity. It has developed a Scientific Misconduct Strategy with procedures for investigating any alleged instances of misconduct. [138] Follow-up actions may be taken by the ERCEA Director (e.g. the suspension or exclusion of proposals from the evaluation procedure, a request for measures to be taken by the Host Institution, suspension or termination of a grant agreement. The ERC's approach is complementary to the broader approach to monitoring the ethical dimension of research activities funded under Horizon 2020, the Ethics Appraisal Procedure.[139] An ethics self-assessment guide has also been developed both by the ERCEA and a separate such self-assessment for H2020 more generally.[140]

[138] ERC. (2012). ERC Scientific Misconduct Strategy. Available at: https://erc.europa.eu/sites/default/files/document/file/ERC_Scientific_misconduct_strategy.pdf
[139] European Commission. (n.d.). Ethics. Available at: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/ethics_en.htm
[140] European Commission DG RTD. (2019). *Horizon 2020 Programme Guidance How to complete your ethics self-assessment*. Available at: https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/ethics/h2020_hi_ethics-self-assess_en.pdf

Scientific ethics and research integrity in the ERC grants scheme and the Ethics Appraisal Procedure in Horizon 2020

Good practices:

1. The ERC's determination to uphold high ethical standards in all its activities by embedding scientific ethics and research integrity in evaluation and selection procedures and in project monitoring.
2. A proactive approach to following up on information about instances of scientific misconduct.
3. The development of guidance for individual researchers [141] on how to integrate ethical consideration and research integrity into the design and execution of a research project, including during the data collection and analysis stages.
4. Undertaking an ethical review of research projects where ethical issues are identified as being especially relevant.
5. Looking to H2020 projects more generally, some projects appoint an ethics adviser/advisory board to assist projects from the beginning.

Relevance to universities: Universities take part in the ERC grants indirectly as host institutions. Many leading research universities regard the grants as being prestigious. The step by step guide to carrying out a self-assessment of ethical aspects of research projects is useful, and such good practice guidance complements initiatives such as the development of a European Code of Conduct for Research Integrity [142] which is widely recognised as a general framework for research integrity. The 2017 revised edition of the Code addresses emerging challenges emanating from technological developments, open science, citizen science and social media, among other areas.

Lessons learned: The ERCEA has streamlined its ethical review procedures during projects to avoid lengthening the amount of time before projects can get underway. It now carries out an ethical review of research projects only in the case of projects identified as posing particular challenges. Therefore, the need to ensure that ethical review procedures are proportionate is a key lesson.

4.3.2.5 Possible actions

The EU and Member States will need to ensure that regulatory and policy frameworks and requirements attached to funding streams stay up to date and relevant in view of changing needs and challenges related to research integrity and scientific ethics. Integrating scientific ethics strongly within EU programmes in which individual researchers are participating should help contribute to a stronger culture of trust in research built on more systematic consideration of scientific and research ethics from the outset. For example, the ERC grants are regarded as highly prestigious by universities and could serve as an effective instrument in incentivising more ethically conscious research.

Another promising avenue that could be pursued is that of **research on ethics**, and more particularly on emergent ethical challenges. This **reflexive approach** appears to be particularly well-suited to engage researchers in the continuous revaluation of ethical issues as they emerge. The ethical horizon being constantly evolving, the newly formed academic discipline has the potential to reveal itself particularly well-equipped in helping avoid—or lessen the risk of—major ethical pitfalls before new technologies are fully developed.[143] For instance, the AI ethical guidelines alongside the EU Commission (DG CONNECT) in 2019 is illustrative of a collaborative initiative between government and academia, which sought to better apprehend the potential ethical risks posed by AI. Similar collaboration in other technology areas should be pursued. Similar initiatives could be

[141] ERC. (2018). *Ethics Self-Assessment step by step*. Available at: https://erc.europa.eu/sites/default/files/document/file/EthicsSelfAssessmentStepByStep.pdf
[142] ALLEA. (2017). *The European Code of Conduct for Research Integrity: Revised Edition*. Berlin: ALLEA. Available at: https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf
[143] Brey, P. (2017). Ethics of Emerging Technologies. In S. O. Hansson (Ed.), *Methods for the Ethics of Technology*.

implemented in the EU.

4.4 TM3: A strategic European Research and Innovation agenda: the central role of universities as research actors.

4.4.1 Introduction

As discussed in TM1, institutional autonomy and academic freedom are crucial governance prerequisites for universities. Academic freedom is crucial for individual academics to maintain their independence and scientific and research credibility.

Whilst universities determine their own research strategies, they do not do so in vacuum, as research strategies and agenda-setting typically considers both internal and external factors.

As regards **internal factors** that influence the development of universities' research agendas, given the heterogeneity of universities, examples are: a university's disciplinary (and/ or inter-disciplinary) research strengths, the degree of emphasis given to different types of research (e.g. basic/ fundamental, applied and the wide spectrum in-between), the type of university (and the relative importance of its different missions, including research and innovation), its budgetary size (which in turn is dependent on demand for teaching staff and teaching income as this determines who gets hired (and therefore what research topics are covered by staff), and how big different departments are.

However, **external factors** also influence the evolution over time of universities' research priorities, both at EU and national levels. The EU provides strategic directionality in determining research priorities, and some of these priorities may coincide with those of universities, for instance, interest in climate change research, artificial intelligence, ageing societies and health research. Whilst it is entirely up to universities the extent to which they consider these priorities, strategic R&I planning processes at EU level provide an overarching framework, especially for mission-oriented research designed to tackle the societal challenges.

The existing Strategic Planning process of the future Horizon Europe involves a joint effort between the Commission, Member States, and national stakeholders, including universities. This provides a strategic focus and reference point to improve the coordination of EU-level research efforts. However, EU-level research funding priorities are only one influence (among many others) that universities consider in determining their own research agendas. Universities account for approximately 40% of participation in the EU RTD Framework Programmes, and therefore, mission-oriented, thematic research funding priorities at EU and national levels are an external factor to be considered. However, Horizon 2020 accounts for circa 15% maximum of third-party funding for the research budgets of Europe's leading and most successful universities in competitive research funding, but in most cases, the percentage is much less, and therefore hiring decisions are only partially influenced by EU funding priorities.

An important consideration, however, is that the level to which research-intensive universities participate in the challenge-driven parts of Horizon 2020 depends on the Technology Readiness Levels (TRLs). Whilst many universities participate in research projects across several different TRL levels, they have particular strengths in frontier research at earlier TRL levels (e.g. basic research). If the focus is increasingly on applied and close to market projects, universities focused on basic research may be unlikely to endorse thematic priorities in the short term in their R&I strategies. The extent of future endorsement by universities will instead depend on how the future priorities of Horizon Europe are articulated, for instance, whether these are priorities for knowledge production, or priorities for uptake. Among the feedback from the university networks in this regard was that such priorities would become more aligned with scientific interests if scientists were consulted more closely through advisory groups and could then contribute more fully to the determination of the priorities, which would help to secure their buy-in.

Whilst fully respecting the fundamental principle of universities' autonomy and academic freedom, there are examples of how strategic developments at an EU level can provide a positive impetus to the process of universities reflecting on their own needs and strategic priorities to deliver on their R&I mission, such as those illustrated below:

Impact of external developments at EU level and universities' research and human resource development strategies

Many universities have adapted their HR strategies, so that they are aligned more closely to the principles set out in the **European Charter for Researchers and the Code for the Recruitment of Researchers.** The European Charter for Researchers is a set of general principles and requirements which specifies the roles, responsibilities and entitlements of researchers. [144] To date, 1228 organisations (mainly universities) have endorsed the Charter & Code principles and a Code of Conduct for the Recruitment of Researchers.

Many universities have also applied for the **Human Resources Strategy for Researchers or HRS4R label,** [145] which was introduced and is modelled on Article 32 in Horizon 2020's model grant agreement (making the implementation of the Charter and the Code by beneficiaries close to mandatory, 'best effort'). The 'HR Strategy for Researchers' supports research institutions and funding organizations in the implementation of the Charter & Code in their policies and practices. This does not in itself constitute evidence that actual practices have changed, which would need to be assessed by appropriately qualified external consultants/ assessment bodies.

A further example is that because of the **'portability' feature of the ERC grants, universities changed their policy on tenure track and tenured positions.** They either offered more flexible salary packages (or encouraged their governments to do so) in order to be able to retain ERC grantees. The drivers of such changes were the risk of losing top researcher talents, and/ or failing to meet the programme conditions for funding.

Similarly, when the EIT was launched, several universities who were already quite strong in innovation, decided to **develop interdisciplinary research departments**, to prepare for the EIT-KIC bids in a concerted manner together with their partners in business and in other research organisation. A potential incentive to join forces and to collaborate on an interdisciplinary basis came from the top down, but the way in which it has been implemented was down to individual universities and researchers who decided to cooperate. A driver was the potential to develop new collaborative relationships with companies, gaining easier access to technology transfer services, and obtaining additional EU funding to support entrepreneurial training.

The European values underpinning the Vision, objectives and values outlined in Section 3.3 and 3.4, as well as the assessment of the legal framework make clear that the autonomy of universities is an important principle, supported in various declarations, including among others (see Section 3.4 for details), the Magna Charta Universitatum.[146]

However, there are in practice differences across Europe as to the degree of autonomy. For example, some universities are fully autonomous and determine their own research priorities, whereas in others, there is a large degree of autonomy, but working within the broad parameters set by national higher education authorities. This also depends on

[144] See https://euraxess.ec.europa.eu/euraxess/charter-code-researchers
[145] The Human Resources Strategy for Researchers https://euraxess.ec.europa.eu/jobs/hrs4r
[146] University of Bologna.(1986). *Magna Charta Universitatum*. Available at: http://www.magna-charta.org/resources/files/the-magna-charta/english

prevailing funding mechanisms for universities (e.g. the balance between the block grant, and competitive research funding).

Research by the EUA[147], for example, has shown that the degree of national influence on universities' research priorities varies, reflecting different traditions and degrees of autonomy across higher education systems in different Member States. Consequently, there are variations between EU Member States as to how autonomous research agenda setting is. This Vision fully supports the need to reinforce the autonomy of universities to set their own research agendas.

EU research and innovation (R&I) funding priorities, especially the topics selected for support through calls issued within the RTD Framework Programme, with input from the Member States through Horizon 2020 Programme Committees, exercises an influence on the European research and funding landscape, for instance by shaping national research agendas and providing a common reference point for different research actors, including universities, in Europe and beyond. This has an important structuring effect, for instance, in influencing how research actors positions themselves through the formulation of consortia, and the submission of proposals in response to calls etc.

Key trends and developments in thematic research and funding priorities shape universities' research agendas. For example, the focus in Horizon 2020 on societal challenges such as global health challenges and climate change, have had an impact in shaping national research and innovation agendas, as well as the agendas of research-performing actors, including universities. Looking ahead to Horizon Europe 2021-2027, there is expected to be a continued focus on societal challenges (including their global dimension) but there are also likely to be changes in research funding priorities, such as strengthening attention to environmental sustainability and the circular economy even further, in order to better contribute to strategic EU policy objectives relating to the Green Deal. EU level priorities will therefore continue to provide the backdrop in which universities determine their own research agendas.

National authorities and funding bodies responsible for R&I in some Member States purposely align their national competitive research funding programmes (and associated funding allocations) closely with EU R&I thematic priorities, especially in the societal challenges. Alignment between funders at national and EU level is a positive thing, not least for the efficacy of EU funding. However, given universities are autonomous, they should forge their own research agendas. Even where universities have a high level of autonomy, external factors will still have an impact.

There may be some common aspects of universities' research strategies, but this will vary considerably between different types of universities, and depend on factors such as which missions they prioritise, their disciplinary focus, etc. At the first stakeholder workshop, strong interest was expressed among universities in Europe to contribute to addressing societal challenges in general, and to the Sustainable Development Goals (SDGs), which are broad in scope.

Lastly, it should be noted that as universities participate in both bottom-up, curiosity-driven research programmes and top-down challenge-driven research programmes, the bottom-up and top-down dimensions should be mutually-reinforcing.

[147] Some countries have experienced a strengthening of university autonomy in the past 20 years as a result of government reforms, such as the Netherlands, whereas this is not the case in other Member States. See for example, Estermann, T. and Nokkala, T., (2009). University autonomy in Europe: exploratory study. Brussels: European University Association.

4.4.2 Challenges

The challenges that could be addressed are now described.

Challenge 1 – Universities that have not yet done so need to develop their own long-term R&I strategies, which build on their strengths, in the context of increasing demand for solutions to address major societal issues, while respecting academic freedom.

Many universities in Europe excel at bottom-up, curiosity-driven research of a longer-term nature, which is widely recognised as having strategic benefits over the medium and longer term.[148] This is crucial to the achievement of excellent science and is achieved both through collaborative, transnational research, as well as through research led by individual lead researchers (e.g. through the bottom-up MSCA and ERC grants schemes).

A balance is needed between curiosity-driven research and applied or top-down topics, for instance in the future Horizon Europe and in other funding programmes. However, this relates less directly to the activities of universities themselves, as there is such a diversity of universities in terms of the degree of focus on their research missions. Striking a balance between the two might be a good idea for some universities, but more typically, in many universities, there is a heavy focus on either one or the other, and in line with their institutional autonomy, universities themselves should decide on the best relationship between the two.

A study providing an analysis of the role and engagement of universities with regard to participation in the Framework Programmes[149] found that "the bottom up approach of Marie-Curie and the ERC is extremely positive", as they contribute strongly to excellent science. Moreover, the ERC grants scheme attracts globally-leading individual research talents at different stages in their researcher careers who undertake bottom-up research project in host institutions. Whilst the ERC ensures that globally-leading researchers in their fields either stay in or are attracted to come to Europe, intra-EU, due to the portability of the grants, there is a risk of brain drain (addressed in TM4 on human capital).

ERC grantees frequently elect to use their grant to undertake their research at one of Europe's leading research universities, rather than in their own Member State. Evidently, there are many advantages of international researcher mobility, however, the counter-argument that the risk of brain drain could materialised should also be considered. Overall, however, bottom-up research undertaken through the ERC grants has made a highly positive contribution to strengthening scientific excellence in Europe. Moreover, in their capacity as host institutions, universities are at the heart of this programme.

A clear value added of universities' research functions is that they deliver excellent science through bottom-up, curiosity-driven research. Indeed, at the stakeholder seminar held in Brussels on February 13th and 14th, a representative from CAESAR made the point that the most successful national funding organisation in Europe, the Swiss National Foundation, is distinguished through its emphasis on bottom-up research funding. Universities provide a strategic, longer-term function in undertaking research that could lead to incremental results whose importance can sometimes only be appreciated or understood much later down the line.

[148] Strandburg, K.J. (2005). Curiosity-driven research and university technology transfer. University entrepreneurship and technology transfer: Process, design, and intellectual property, pp.93-123.
[149] European Commission, Directorate-General for Research and Innovation. An analysis of the role and engagement of universities with regard to participation in the Framework Programmes. Authors: IRCrES, Ismeri Europa and Politecnico di Torino. https://op.europa.eu/en/publication-detail/-/publication/640a37db-0b71-11e6-b713-01aa75ed71a1,

Europe had been lagging behind the USA in terms of research with the highest impact (articles among 1% most cited), but the gap has narrowed since ERC was created. For example, according to a 2017 study, which examined the ERC's impact in the 10 years since its establishment, had the "highest category normalised citation impact, the highest percentage of papers in the world's top 1%, and the highest percentage of papers involving international co-authorship of the 50 funders most frequently acknowledged by authors in the Web of Science between 2007 and 2016."[150] Universities' involvement in the ERC grants, by providing the research facilities where ERC grantees undertake research, is central. As two-thirds of the funding goes to young researchers, universities also benefit from strengthening their capacity to deliver excellent science and research by retaining a proportion of young researchers once their ERC grant research project has been completed. There is however a danger of reinforcing the problem of the concentration of funding in leading research universities.

Whilst recognising the importance of bottom-up research, there is a tendency in parallel for EU and national research funding bodies to focus on research into the more immediate societal challenges on the radar of both policy makers, wider societal actors and citizens. Turning to top-down, challenges-based competitive research funding, this is also an important element of many universities' research activities.

Nonetheless, at EU level, universities are essential research performers for both bottom-up, curiosity-driven research funding programmes and top-down funding programmes, such as Horizon 2020, Pillar 2, which outlines mission-oriented and challenge-based research approaches. Ideally, a balanced approach is needed regarding universities' role in both these crucial aspects of the European R&I landscape, given that universities have such an important contribution to play in both.

It should be stressed that the European Commission's approach to the future missions and challenges in Horizon Europe (through a directional approach) will purposefully ensure that a non-prescriptive approach is adopted in which universities have the full freedom to operate. The upcoming Missions and other collaborative research project calls are focused on specifying the high-level policy objectives and desired research impacts, but leaving it completely up to research performing actors and individual scientists to determine how their research is carried out, and to define pathways to the expected results. The way in which an interdisciplinary team moves towards achieving particular desired research impacts is left up to research teams so as to foster creative and societally-relevant research solutions. This approach is also endorsed by the expert group on the Economic and Societal Impact of Research (ESIR), which states in its memorandum towards a mission-oriented R&I policy in the EU that "research and innovation strategies are the pillars of Europe's 2030 strategy: achieving growth that is smart, inclusive and sustainable. Key to this process is providing a direction for change, while also enabling bottom up experimentation and exploration''.[151]

The university networks were supportive of engaging in EU-funded, challenge-led research programmes, provided that the focus on bottom-up, curiosity-driven research remains undiminished. One network commented that "thematic calls can be very useful in particular to address societal/ environmental challenges, however they should not restrict blue-sky research and undervalue serendipity". Another network noted that within challenge-driven programmes, there should be enough support for collaborative fundamental research, not just innovation-oriented projects with SMEs. Fundamental research and challenge-driven research are symbiotic.

[150] Clarivate Analytics, The European Research Council, The first 10 years.
[151] European Commission, ESIR. (2017) Towards a Mission-Oriented Research and Innovation Policy in the European Union; An ESIR Memorandum.

A good example cited in this regard was that fundamental research had been undertaken to attempt to develop a better understanding of coronaviruses in recent years, and this topic was initially EU-funded post-SARS, for example. However, as it wasn't made a political priority over the medium-term, funding was discontinued but has now been restarted. The fundamental research undertaken earlier has helped to speed up the development of vaccines. This area of research has again become a top-down priority. This illustrates that fundamental, curiosity-driven research can contribute significantly to addressing pressing societal challenges, and therefore that fundamental research and challenge-driven research are not polar opposites, but rather complementary.

Challenge 2 – The importance of addressing urgent global societal challenges and maximising Europe's contribution to the Sustainable Development Goals (SDGs). Harnessing the full potential of universities for the benefit of society through challenges-based, solutions-driven research and innovation.

Research-performing actors generally, and universities in particular, have a crucial role to play through their research activities in strengthening Europe's contribution to the achievement of high-level EU policy goals, such as combatting climate change, addressing the issue of ageing societies and contributing to the SDGs.

Indeed, at the first workshop, university networks and other stakeholders stressed that the SDGs is an area where although universities are already contributing, they would like to play a more pro-active role and to enhance their existing contributions. Moreover, it was stressed that the under-graduate and graduate student body are putting pressure on universities to step up to the challenges of addressing the SDGs. However, it was also pointed out that whilst some universities have a strong disciplinary interest in research into the SDGs, this depends on the university's mission.

Many universities are already involved in cutting-edge, challenge-driven research, and in addressing societal and environmental issues, such as tackling global health challenges, ageing societies, the development of new technologies and digitalisation, and combatting climate change, including by fostering a circular economy and developing research solutions to support sustainable development. A consideration is the question as to how universities might articulate their contributions more effectively and convince decision-makers to take their research results into consideration when they deliver knowledge that decision-makers should act upon. Again, the example of coronaviruses can be considered as there was significant knowledge about the risks and likelihood of a pandemic coming from the research and scientific community for many years, yet this still came as a surprise to many politicians, governments and to the general public. It has also been revealed that there was insufficient preparation for such an eventuality.

The achievement of objectives linked to the implementation of the Paris Agreement and Sustainable Development Goals (SDGs) set out in the United Nations 2030 Agenda for Sustainable Development[152] will need the continued and active role of all European research actors, including universities. Increasing the current EU 2030 target on reducing greenhouse gas emissions from 45% to 50-55% in 2030, as foreseen in the European Commission's Green Deal Communication[153] and Action Plan, demands an intensification of research efforts at the European level. universities are committed to addressing priorities such as climate change through research and action, but given the emphasis on institutional autonomy and academic freedom, this is irrespective of the Commission's priorities.

[152] United Nations. (2016). Transforming our world: The 2030 agenda for sustainable development. Available at: https://stg-wedocs.unep.org/bitstream/handle/20.500.11822/11125/unep_swio_sm1_inf7_sdg.pdf?sequence=1

[153] European Commission. (2019). *The European Green Deal, COM(2019) 640 final*. Available at: https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

It is therefore a matter of instigating a period of reflection – supported by ongoing consultation with the university networks and other relevant stakeholders – as to how best the Commission can support universities in achieving their ambitions to contribute through both fundamental research and their participation in some mission-oriented research where they are keen to take part in competitive research funding. This in turn should help the Commission to achieve its goals.

The 2019 European Reflection Paper "Towards a sustainable Europe by 2030"[154] reinforces this as it points out that to achieve ambitious goals (such as the SDGs) and to tackle key global or European challenges, the EU requires a strong and timely evidence base. This requires critical research mass in priority areas such as climate change, addressing demographic change and ageing societies and global health challenges.

Bottom-up research programmes implemented through a curiosity-driven approach, both EU and nationally-funded, as well as research funded by universities, contribute to strengthening critical research mass in Europe. In addition, through a societal challenges and mission-driven approach, EU R&I programmes help to foster critical research mass. Both types of R&I programmes contribute to fostering excellence in science, which should help to improve universities' research capacities and strengths and to generate new knowledge relevant to addressing the SDGs.

Lastly, the important role played by universities in tackling global health challenges, such as the current Covid-19 pandemic should be reflected upon by EU and national policy makers, and by universities themselves. Any lessons learnt, and implications that might influence the future role of universities in contributing to the SDGs and to tackling global health challenges (including those arising unexpectedly) should be considered.

Challenge 3 – Research funders across Europe at EU and national level should strengthen their existing efforts to extract policy-relevant messages from groups of research projects. This could be supported by universities, as crucial players in performing bottom-up research, and as host institutions for portable ERC and MSCA grants.

Given the nature of bottom-up research, and the longer-term time horizon over which the research is carried out and useful, incremental research outcomes materialise, it is arguably challenging for policy makers, industry and societal actors to identify useful emerging lessons from research projects. Indeed, the nature of scientific activities, given that there is no linear approach to scientific enquiry and to innovation, may make it unclear even to the researchers and scientists conducting the research what is likely to be immediately useful, given the focus of curiosity-driven research on the medium and longer-term.

It is therefore challenging to extract policy-relevant messages and to communicate scientific and research results. There is also a question mark as to who should be responsible for doing so, as some of the university networks questioned whether it is their role to extract such information.

There are examples of good practices in the provision of policy feedback that rely on the extraction of bottom-up research. For example, the ERCEA, the Executive Agency which provides the technical secretariat for the Scientific Council has a unit dedicated to policy analysis, and has undertaken a synthesis analysis of groups of ERC grant projects centred around different thematic clusters of projects in in areas such as tackling climate change,

[154] European Commission. (2019). *Reflection Paper "Towards a sustainable Europe by 2030".* Brussels: European Commission: Available at: https://ec.europa.eu/commission/sites/beta-political/files/rp_sustainable_europe_30-01_en_web.pdf

cancer research, artificial intelligence, etc. The aim was to showcase the types of projects being supported, interesting emerging results coming out from such projects, etc.

If efficient ex-post mechanisms are either already in place, or established by universities to catalyse knowledge generated, especially from but not limited to curiosity-driven research, then this could facilitate the clustering at different levels (e.g. university level, local/ regional level, national and EU levels) to harness the results of basic scientific research more fully. This could inform the development of expertise in particular thematic areas of research, could help to raise awareness about universities' research strengths and facilitation collaboration with other centres of research excellence, whether these are universities or universities working in conjunction with other research actors. It could also provide an impetus to strengthen policy feedback, and to better communicate to potential users of research results the usefulness of scientific research.

This is already happening to some degree through the work of the European Research Council Executive Agency (ERCEA). and the Research Executive Agency (REA), the two delegated executive agencies[155] that manage the ERC and MSCA grants on the Commission's behalf. The two agencies monitor the scientific and research impacts – and potentially the policy-usefulness of research outcomes – of the bottom-up MSCA and ERC grants, where researchers are hosted by universities in their capacity as host institutions.

Scientific results across groups of bottom-up, frontier research projects clustered thematically could be used to better inform the directionality of EU R&I strategies to ensure that the results of curiosity-driven research closely inform the formation of strategic R&I policies at EU level.

Challenge 4 – Universities already cooperate both intersectorally <u>and</u> internationally. However, the level of interaction with other sectors could be expanded further to enable universities to strengthen their contribution to societal challenges and related missions in Horizon Europe and to the SDGs.

Whilst many universities already engage with other sectors, and have international links, engagement could be strengthened in future so as to enhance the capacity of universities' research missions in contributing to the societal challenges and related missions in Horizon Europe and to the SDGs.

The data below from the MORE 3[156] study provides information regarding the extent of intersectoral and international cooperation by researchers. Whilst it is only a proxy, as it relates to individuals, rather than universities as institutions, it demonstrates that researchers are already engaging in contributing with other sectors, and have links with researchers in other countries.

[155] The main executive agencies concerned are the ERCEA (ERC grants) and the EACEA (MSCA).
[156] Janger, J., Kügler, A., Bärenthaler-Sieber, S., Strauss, A., Hofmann, K., Van Hoed, M., Lopez, L.N. and Wastyn, A., (2017). MORE3–Support Data Collection and Analysis Concerning Mobility Patterns and Career Paths of Researchers. Final Report–Task 4: Comparative and Policy-relevant Analysis. WIFO Studies.

As detailed in TM5, universities already have extensive links with other sectors, which puts them in a unique position to engage with different societal actors beyond the conventional university-government-industry/business axis. This has particular relevance in a 'societal challenges' context.

The quintuple helix model of innovation recognises that progress can be made through the application of knowledge and know-how and the societal exchange and transfer of knowledge involving a broad range of actors in research activities. In the context of the SDGs, it will be especially important to reach out to representatives from civil society (e.g. NGOs, CSOs).

Challenge 5 – The need to support 'directionality'[157] in the research and innovation field at EU level by mobilising efforts at an ecosystems level and to improve collaboration between Europe's research-performing actors to consolidate and enhance critical research mass.

Directionality is already provided through the European Commission's Strategic Planning process, and by the Commission's priorities for the 2019-2024 period and beyond.[158] However, achieving strategic EU-level priorities for R&I needs to be supported at the implementation level by mobilising the support of all research performing actors in Europe, among which universities play a crucial role. This would better enable the EU to make progress towards strengthening the contribution of the EU to the achievement of the SDGs and of the priorities outlined in the Green Deal.

It should be explicitly mentioned, however, that bottom-up research, through for instance the ERC and MSCA, will necessarily remain crucial. It is therefore more a matter of ensuring that maximum utility can be drawn from such curiosity-driven research as this is crucial to achieving excellent science. However, there could be means of improving synergies between bottom-up and top-down research, in a way that is beneficial for all stakeholders, whilst crucially maintaining the principle that researchers and universities themselves should determine their research priorities.

As universities have expressed strong interest in improving their contribution to the SDGs and sustainable development, ensuring that there are stronger linkages between universities and regional innovation ecosystems in contributing to top-down research and priorities related to the societal challenges is important. However, this Is about improving the structures, processes and rewards for collaborating with external stakeholders. This is also addressed in TM5 (cooperation with other sectors).

The EU policy framework on societal challenges has recently been updated to reflect the new Commission's key identified challenges and now includes the European Green Deal, Europe's new agenda for sustainable growth and the revised March 2020 Circular Economy Action Plan [159], one of the Green Deal's main building blocks. It could also provide an indication of the relative degree of priority of different societal challenges. A further relevant source of inspiration is the 2019 Commission paper outlining reflections for a more sustainable Europe.[160] The impact of COVID-19 on key EU policy priorities would

[157] Directionality is a process whereby the EU provides an overarching R&I policy framework through which resources can be devoted at EU level, for instance, the focus on the grand societal challenges.
[158] The six headline ambitions of the von der Leyen Presidency for 2019-2024 are: A European Green Deal, An economy that works for people, A Europe fit for the digital age, Protecting our European way of life, A stronger Europe in the world and A new push for European democracy. See von der Leyen, U. (2019). A Union that strives for more: My agenda for Europe. Available at: https://ec.europa.eu/commission/sites/beta-political/files/political-guidelines-next-commission_en.pdf
[159] European Commission. (2020). *Press Release: Changing How we produce and consumer: New Circular Economy Action Plan shows the way to a climate-neutral, competitive economy of empowered consumers*. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_20_420
[160] European Commission. (2019). *Reflection Paper: Towards a sustainable Europe by 2030*. Available at: https://ec.europa.eu/commission/sites/beta-political/files/rp_sustainable_europe_30-01_en_web.pdf

also need to be considered in an updated policy framework on R&I, which could give greater priority to global health challenges.

Universities are uniquely placed and work across all the above-mentioned societal challenges.

More specifically, the directionality provided by having an overarching policy framework at EU-level could help to:

- Enable universities to contribute across different strategic policy priority areas, considering their diverse research strengths overall, and the specific disciplinary and / or inter-disciplinary focus of particular institutions.
- Enable universities to make a full contribution to evidence-based policy-making at EU, national, regional and local levels across the major societal challenges identified. This is supported by Art. 179 of the TFEU[161] (promoting research activities).
- Create an enabling policy and regulatory framework so that universities are able to contribute even further through their research mission towards high-level EU policy priorities.
- Keep Europe's 5000 universities regularly informed about the intended thematic priorities and funding allocations in Horizon Europe across the different societal challenges (SCs). This would encourage universities to position themselves early, and to establish collaborative transnational consortia on particular research topics, both with other universities and with other research-performing actors.
- Strengthen critical research mass in Europe so as to improve overall research capacity in tackling the societal challenges, and to ensure greater resilience when faced with unexpected research needs, which demand a prompt reaction, such as the COVID-19 pandemic.

There is an issue as to whether in order to achieve the objectives in the EU's strategic research and innovation agenda, there is a need to engage a wider range of universities and other research actors than is currently the case. Currently, top-performing universities dominate FP participations, which are based on excellence. However, the portability of bottom-up, research grants awarded on the basis of excellence may, according to some stakeholders have a skewering effect in increasing the concentration of funds among top R&I universities. The conundrum is whilst this reinforces scientific excellence, it arguably also contributes to the exacerbation of the brain drain problem, and therefore, possible means of promoting brain circulation need to be explored.

However, there is arguably a need given the importance of enhancing critical research mass to rise to the scale of societal challenges also to enable a broader spectrum of universities in Europe to contribute. In a widening context, it can be observed that many, but by no means all, universities in Central and Eastern Europe are less well-represented in the FPs.

However, there is no suggestion of changing the focus in the FPs on Excellent Science, which in Horizon Europe will remain the basis for achieving a successful knowledge society. It would nevertheless arguably be helpful to draw on a wider range of universities from across Europe to contribute to addressing European and global level societal challenges.

[161] Art. 178 - The Union shall have the objective of strengthening its scientific and technological bases by achieving a European research area in which researchers, scientific knowledge and technology circulate freely, and encouraging it to become more competitive, including in its industry, while promoting all the research activities deemed necessary by virtue of other Chapters of the Treaties. European Union. (2008) Consolidated version of the Treaty on the Functioning of the European Union, 13 December 2007, 2008/C 115/01, Available at: https://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:12012E/TXT:EN:PDF

Moreover, the involvement of a wider range of universities would ensure that a greater diversity of national, regional and local perspectives is brought to bear on the kinds of global societal challenges addressed by the Green Deal or the SDGs (see Challenge 6).

Excellent science – lifting all boats and creating more global winners

In a widening context, it has been noted that many universities in countries that perform less well in accessing competitive research funding have been excluded from contributing to strategic EU-level research agendas and from taking part in excellent science and research.

This risks exacerbating a vicious circle in which top-performing research universities win competitive research funding and attract portable research grantee recipients. This means that the strong become ever-stronger, whereas other universities may struggle to compete in gaining access to competitive research funding, even if they carry out excellent science and research. For example:

- Some universities have dedicated staff and units to support academics and researchers in the process of preparing FP applications, whereas others do not.
- Some universities are preferential choices for ERC grantees as host institutions, and for mobile MSCA researchers, and attract considerable funding, whereas others suffer from brain drain.
- However, it can also be pointed out that these problems exist at national level too, as universities with better R&I infrastructures tend to attract more ERC grantees.

Significant progress still needs to be made in most universities in countries eligible for widening support in Horizon 2020 (and in the future Horizon Europe) to strengthen their capacity to take part in transnational research on the societal challenges. This is due to the difficulties they face as prospective host institutions in attracting leading-edge researchers with prestigious (portable) ERC and MSCA grants. They may attract some excellent researchers, but compared with leading universities in Europe, they attract significantly fewer researchers.

Regarding the baseline situation of the level of participation in the RTD Framework Programmes in EU-13, universities in the newer Member States are often at the lower end of the participation rankings. "Yet, some EU-13 Member States are developing quickly and have excellent research centres with cutting-edge research facilities financed via Operational Programmes. These countries are in the process of adapting the attitude of researchers and their national research systems to the international research area".[162] Examples of better-performing Member States in the FPs are Cyprus, the Czech Republic, Estonia, Hungary and Slovenia.

Challenge 6 – The need to reinforce and further strengthen interdisciplinary approaches to addressing European and global societal challenges.

In some research areas, an interdisciplinary approach may be the most effective means of driving innovative research and solutions to tackle societal challenges. It was argued during the stakeholder consultation workshops that delivering societally-relevant research requires an interdisciplinary approach more frequently, as the challenges are multifaceted and complex. They moreover often require joint cooperation between different research and societal actors.

There are growing demands on universities and on individual researchers and academics to embrace interdisciplinary approaches. A paper on the scientific and societal relevance of interdisciplinary sustainability research notes that "Academics are increasingly expected to produce concrete and directly applicable solutions to hard-to-solve 'real-world problems' such as poverty, development, and environmental degradation. However, conventional

[162] Regarding the baseline situation, overcoming innovation gaps in the EU-13 Member States, commissioned by the Scientific Foresight Unit (STOA) within the Directorate-General for Parliamentary Research Services (DG EPRS) of the European Parliament. See https://www.europarl.europa.eu/RegData/etudes/STUD/2018/614537/EPRS_STU(2018)614537_EN.pdf

assessments of the impact of science on society have not yet been adequately adapted to capture the diverse effects of this type of problem-centred research".[163]

Many universities have made significant progress in interdisciplinary teaching and research. Yet there may be structural barriers within universities to adopting a more disciplinary approach. For instance, many universities continue to operate their research activities along disciplinary lines and research funders too often think in disciplinary terms. It remains the case that some universities only undertake limited research activities on an interdisciplinary basis, and research positions are typically disciplinary. The importance of developing interdisciplinary approaches within universities, and institutionalising these, for instance in recruitment practices at all researcher levels R1-R4, was raised at the first stakeholder workshop (13th/14th February, 2020) for this study. Related issues are explored in Section 4.5 TM4 (human capital).

Whilst there have been efforts towards supporting interdisciplinarity in the past decade, those working in interdisciplinary teams are often torn between on the one hand, incentives towards interdisciplinarity (e.g. funding for an interdisciplinary research project) and on the other, incentives that pull them in the direction of mono-disciplinarity, such as ontological organisational structures, such as faculties and departments (= decision-making powers) and/ or job vacancies that build on existing monodisciplinary gaps in expertise (= recruitment power). A striking example in this regard is that evaluation frameworks differentiate between disciplines with the best intentions (e.g. publication culture in psychology is different from medicine), but by doing this, set different standards for team members of the same team (e.g. psychologist, engineer and neurologist collaborating on brain research and each being evaluated differently by their faculty).

There are how good practices on alternative career paths for postdocs, as illustrated in this report in further detail from Ghent University (see case study on the role of Interdisciplinary Consortia coordinators in TM5 (cooperation with other sectors).[164] These consortia support interdisciplinary research; the funding for the consortia relies on interdisciplinary, collaborative achievements, but the members in these consortia are still members of their respective faculties and continue to struggle with funding from other monodisciplinary sources, traditional organization structures, etc.

Challenge 7 – The ongoing need for universities to consider the local dimension of global societal challenges.

Whilst many societal challenges are global and require international cooperation and engagement in research by universities, the local level should be given continued strong attention between now and 2030. Universities' active participation in addressing the implications of major societal challenges, but at a local level could help them to better engage with citizens (see TM2 on maintaining trust in universities, and TM5, which stresses the importance of universities engaging with citizens).

A further issue is that there may be many pressing social challenges that may not yet be apparent or the subject of public discourse, where research produced by universities could have a major societal benefit at local level over the medium and longer-term. Localised research to address societal challenges that have a local dimension and which are visible in the community could be given greater attention.

Regarding the possible role of directionality in this regard, key R&I priorities are set at EU level, but many of these will have resonance with the research community at national level. There are likely to be many commonalities between universities and between

[163] From invisibility to impact: Recognising the scientific and societal relevance of interdisciplinary sustainability research, Henrike Rau, Gary Goggins and Frances Fahy.
https://www.sciencedirect.com/science/article/pii/S0048733317301907
[164] https://www.ugent.be/en/research/research-ugent/trackrecord/idcs.htm

countries in terms of the societal challenges being faced e.g. global health pandemics, health issues in the population generally, such as the obesity crisis, ageing demographics, the effects of climate change etc. Therefore, whilst specific research priorities will be determined at the university level, many of the challenges and research needs at local level among wider society are linked to the broader societal challenges.

Strengthening the local dimension of societal challenges through universities involvement in mission-oriented research, be this funded at EU or national level, could help to maintain public trust in science, as citizens may gain an appreciation of how research funding into tackling such challenges is not something abstract with benefits at the European or global level but one which tackles problems of relevance to EU citizens at local level.

4.4.3 Transformation needs

Study feedback from the stakeholder consultation workshops was that many universities in Europe are interested in strengthening their contribution to tackling societal challenges, particularly the realisation of the SDGs. This implies enabling even more universities across Europe to be able to contribute than is presently the case. It also implies an effort at EU level to support the development of critical research mass across different societal challenges.

Whilst recognising that universities are well-placed to engage in societal challenges given their disciplinary (and in some cases also inter-disciplinary) research strengths, it will need to be recognised that given the diversity of the European university landscape, not all universities will share the aspiration or research capabilities to contribute. Therefore, engagement should be sought in this module with universities in Europe interested in contributing to the societal challenges and SDGs.

Those universities concerned will need to actively strengthen their capacity to engage in research activities on topics relevant to the SDGs and other pressing societal challenges, such as global health challenges. They need to catalyse research know-how and knowledge generated by research over the longer-term.

Suitable mechanisms will also need to be identified to harness the combined research potential of universities, including consideration of the potential coordination role the university networks might play in helping the EU to develop sufficient critical research mass to address the most pressing societal challenges.

The speed at which new societal challenges emerge, and the nature of existing challenges, continues to evolve. In light of the COVID-19 pandemic, an example might be the importance of research performing actors in Europe giving increased attention to global health challenges. Universities have shown themselves as being capable of rising to the challenge of adjusting their research activities at short notice by their responsiveness to addressing the need for urgent research to be carried out on how best to tackle the COVID-19 pandemic, not only their role in undertaking research into a possible vaccine, but also in the provision of guidance to politicians as to how to minimise the spread of the virus, and their research (backed up by active societal engagement) on its societal impacts.

Overall, universities will need to ensure that their research agendas continue to be sufficiently flexible, adaptable and responsive to respond effectively to changes in identified needs, including those that arise very quickly, especially as regards challenge-led research and innovation activities. Maximising flexibility requires balanced investments between curiosity-driven research (long-term knowledge creation, including the early identification of future challenges) and directional efforts (through a strategic focus on the most pressing societal challenges to solve the most immediate challenges).

Universities should also strengthen their training capacity to ensure that researchers are equipped to deliver highly creative, solutions-oriented, societally-relevant research, and at the same time improve the resilience of (post)graduates and doctoral researchers to work in the context of rapidly-changing societal needs. Improving universities' capacity to address the societal challenges could in turn improve societal resilience to adapt to change.

4.4.4 Case studies

University ranking systems have advantages and disadvantages. For instance, many of the university networks consulted were not in favour of the existing ranking systems used to monitor the top 100 universities globally, or the criteria used to select these and their weightings. It is however useful to consider the role of alternative ranking systems, even though these may not be perfect and would require further adaptation and refinement.

The Times Higher Education (THE) Impact Ranking assesses universities' performance on the Sustainable Development Goals (SDGs). Whilst this is an interesting example, it is not included as a good practice, as some university networks perceived there to be major weaknesses in its methodology, which was regarded as overly-simplistic with an over-reliance on qualitative factors which could lead to subjectivity in the rankings.

Times Higher Education University Impact Rankings 2019 by Sustainable Development Goals

Purpose of case study: showcase example as to how traditional university impact rankings, which focus on publications, could be diversified to develop better frameworks to assess a wider range of societal impacts, including universities' contribution to the SDGs.

Objectives: The University Impact Rankings strengthen measurement of contributions by universities towards the 17 SDGs used in the methodology, by monitoring and benchmarking their contribution.

Description of activities: Carefully calibrated indicators are used to provide comprehensive and balanced comparisons across three broad areas: research, outreach, and stewardship. Universities' contribution to the SDGs is measured based on the extent of their support for the SDGs through collaboration with other countries, the promotion of best practices and their performance in the publication of data relevant to the SDGs. As regards the methodology used, various metrics are used. To assess the relevance of university research to the SDGs, for example, two metrics are used, such as the proportion of academic publications with a co-author from another country, and the number of publications that relate to the SDGs. The Scopus dataset is used, and all indexed publications between 2013 and 2017 are reviewed.

Evidence is also gathered of a qualitative nature, based on evidence of universities' contributions to the following: (1) policy development with government or NGOs, (2) promoting cross-sectoral dialogue with government or NGOs, (3) collaborating internationally to capture data relating to SDGs, (4) working internationally to promote best practice around SDGs, and (5) supporting the education of NGOs with respect to the SDGs.

A further metric is the publication of SDG reports. University institutions are asked whether they have published any specific data on their performance against the SDGs included in the Rankings. There is an emphasis on open access and open data. For example, additional credit is given for documents that are in the public domain and for data published in an open format.

The list includes more than 450 universities from 77 countries. The top three ranked institutions in 2019, for example, were: New Zealand's University of Auckland, the UK's University of Manchester, and Canada's University of Montreal. However, universities in Europe also feature highly in the rankings e.g. University of Barcelona (4th), Aalto University (5th), University of Amsterdam (6th equal), University of Helsinki (9th) and King's College London (10th).

Key achievements, lessons learned and the scope for improvement:

- The Times Higher Education University Impact Rankings have made a contribution to assessing universities' performance in contributing to the SDGs.

Times Higher Education University Impact Rankings 2019 by Sustainable Development Goals

- Although this ranking is a commendable attempt, there is scope for further improvement of the indicators used, and for the ranking system to move away from the Journal Impact Factor (JIF).
- A weakness of the THE rankings is that many of the qualitative indicators above are subjective.

Replicability / transferability potential: The metrics included and their suitability to assess contribution towards the SDGs could be further improved. If this could be achieved, more universities in Europe could potentially take part in this initiative. A data subset showing the performance of universities in Europe could be developed.

Sources of further information:
https://www.timeshighereducation.com/rankings/impact/2020/partnerships-goals#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/undefined

However, as emphasised by EU university associations and networks such as the EUA and the Guild, Caution is needed against overly-simplistic ways of measuring universities contribution to achieving the SDGs. The SDGs as such are based on a methodology that assumes that pursuing one of the goals can have a positive/negative impact on another goal, which means that a holistic approach to this is needed looking at the interaction of the different goals.

In the wider EU policy context of the Green Deal, an earlier initiative of note is the **Green Metric World University Rankings**,[165] launched in 2010, which ranks universities by their commitment to environmental sustainability. It compares university commitment to going green and sustainability and the scope is therefore relatively narrow. A further initiative is **U-Multirank**,[166] the Commission-supported tool funded under Erasmus+, which plans to include the SDG indicators in future. However, feedback from the university networks mentioned that the tool requires further promotion.

This study raises the above examples as interesting illustrations as to how contribution to the SDGs and other policy objectives might be assessed at the university level. There are however different views as to how effective these different metrics systems are.

The second example from the Maastricht Sustainability Institute aims to support sustainable development at the local and regional levels, thus contributing to global sustainability.[167]

Maastricht Sustainability Institute (MSI) – Netherlands

Objectives: The Maastricht Sustainability Institute[168] aims to support sustainable development at the local and regional levels, thus contributing to global sustainability.

Description: The MSI provides research, education and learning for sustainable development. It contracts research for policy purposes and for the use of society. MSI opts for interdisciplinary and transdisciplinary approaches in which scientists collaborate with different disciplines and

[165] UI GreenMetric. (2020). *UI GreenMetric World University Rankings*. Available at: http://greenmetric.ui.ac.id/
[166] European Commission. (2019). *2019 U-Multirank ranking: European universities performing well*. Available at: https://ec.europa.eu/education/news/u-multirank-publishes-sixth-edition_en
[167] Maastricht University. (n.d.). Maastricht Sustainability Institute (MSI). [Online]. [Accessed 15 May 2020]. Available at: https://www.maastrichtuniversity.nl/research/maastricht-sustainability-institute-msi /
[168] Ibid.

Maastricht Sustainability Institute (MSI) – Netherlands

stakeholders. They master a diversity of theories and methods to work at the interface of science, policy and society, providing a scientifically sound and societally relevant research.

Furthermore, the MSI's expertise is reflected in sustainability education with the MUST Graduate School[169] running Bachelor, Master's and PhD programmes. The MSI's multidisciplinary staff and international student group form a close-knit learning community.

In addition to its international and national orientation, the MSI is committed to addressing sustainability issues in the region by means of the Maastricht Sustainability Hub.

Key achievements / lessons learned: The MSI strives to find innovative new ways of integrating knowledge across academic divides, between social and natural sciences and between critical and problem-solving research. The MUST Graduate School was awarded the 'Top-rated Programme' label in 'Keuzegids 2019' (Dutch university education guide) for its interdisciplinary Master's course that educates specialists in Sustainable Science, Policy and Society.

Replicability / transferability potential: This type of interdisciplinary approach to education is highly transferable to other contexts and does indeed exist in other countries (e.g. Belgium).

The third example supports intersectoral mobility between academia and the non-profit sector. Whilst this example is also relevant to TM5 (fostering cooperation between universities and non-academia), it showcases different means of strengthening universities' ability to contribute to the SDGs by establishing relationships with NGOs and placing PhD researchers within NGOs to carry out research projects. Moreover, it provides an interesting example, as the programme is purely bottom-up, yet it was the consortium's choice to focus on the SDGs. This demonstrates how bottom-up research can be highly-relevant to top-down strategic R&I policy priorities.

The CAROLINE MSCA co-fund (Collaborative Research Fellowships for a Responsive and Innovative Europe).

Project implementer: Irish Research Council. **Duration:** three years

Funding sources and costs of project: Sources: MSCA co-fund and Irish Research Council. The total cost is EUR 9,204,000 of which the EU contribution is EUR 4,602,000. The funding call was H2020-EU.1.3.4. - Increasing structural impact by co-funding activities.

Purpose of case study: To demonstrate the role of intersectoral mobility schemes in fostering closer cooperation between academia and the non-profit sector to strengthen universities' contributions to the SDGs. This example is also strongly relevant to TM5(fostering cooperation between academia and non-academic sectors).

Objectives of programme: Fellowship scheme for experienced researchers to carry out research either in Ireland or abroad, to gain inter-sectoral and interdisciplinary exposure. **"***CAROLINE is designed to foster partnerships which strengthen international links between researchers their host institutions and organisations at the coalface in working towards a sustainable future. Embedding researchers in international organisations or NGOs leads to important research outputs and quantifiable progress towards sustainability. Moreover, the experience that researchers gain in international organisations and NGOs enriches their career perspectives and prospects."* [170]

Description of activities: CAROLINE involves strengthening cooperation between universities and NGOs and civil society organisations and the deployment of PhD researchers to third countries

[169] Maastricht University. (n.d.). Maastricht University Graduate School of Sustainability Science & Policy. [Online]. [Accessed 15 May 2020]. https://www.maastrichtuniversity.nl/research/maastricht-university-graduate-school-sustainability-science-policy

[170] Irish Research Council. (2018). €4.4 million to be invested in 21 research projects supporting the global sustainable development goals. [Online]. [Accessed 15 May 2020]. Available at: http://research.ie/2018/07/18/e4-4-million-to-be-invested-in-21-research-projects-supporting-the-global-sustainable-development-goals/

The CAROLINE MSCA co-fund (Collaborative Research Fellowships for a Responsive and Innovative Europe).

through the undertaking of mobility periods in-country. There have been three calls under the MSCA co-fund project. A key feature is collaboration between the academic sector, non-governmental organisations and international organisations. The Council funded 19 researchers under the first funding call for CAROLINE, with an additional 21 researchers under the second call. There are two types of fellowships available through CAROLINE:

1) **International Fellowships (3-year duration),** where researchers spend the first two years based at a partner NGO. There is an optional placement(s) within the scheme to NGOs/IOs during both the outward and return phase can be proposed (up to a max. of 6 months in each case), with placement mentor(s).

2) **International organisations (IO) outside Ireland**, with a mandatory return year at the host Research Performing Organisation (RPO) in Ireland and Irish Fellowships (2-year duration), where researchers are hosted by an RPO in Ireland for two years, with a mandatory secondment to an NGO or IO partners in Ireland for research and/or training. An optional placement to NGOs/IOs (up to 3 months) can be proposed, with a secondment mentor.

Relevance to the SDGs: experienced researchers are being funded to conduct research relevant to the UN's 2030 Agenda for Sustainable Development. The Agenda includes goals such as ending poverty and hunger, building sustainable cities and communities, and achieving gender equality.

Eligibility requirements: Researchers can apply from any discipline. Three main evaluation criteria are used to select eligible fellows on the basis of the proposals made, namely excellence, impact and implementation.

CAROLINE researchers must work in partnership with NGOs and international organisations in conducting their research. Potential partner organisations are mainly 'development-orientated' NGOs and those working in support of developing countries. However, participation is not limited to these types of NGOs alone. The Irish Research Council funds both Irish and international researchers under this programme.

Funding per researcher - at the level of individual fellowships, the salary will be determined by the location of the Fellow and the associated country correction co-efficient as specified in H2020 MSCA regulation applicable to the scheme. The salary and allowances rates per year for Fellows are: Living expenses - €55,800 (adjusted by applicable coefficient) □ Mobility €7,200 (years 1 and 2) Additional family allowance - €6,000.

Implementation challenges: the precariousness of academic contracts makes it difficult for academic staff (and their university) to commit to participation over the three-year project duration during which PhDs are involved.

Benefits of participation: benefits for universities were centred on the ability for their PhD researchers to gain experience in a third-country international development context and to help foster more structured cooperation over time with relevant NGOs. From a researcher perspective, among the benefits were the opportunity to engage in international collaboration with suitable NGOs or IOs; - Gaining experience and benefit from intersectoral and international mobility; - Availing of relevant training and career development opportunities; - Increasing the chances of researchers of gaining a future senior research position, including in the non-academic sector.

Replicability / transferability potential: Wider participation in, and funding for, such schemes could strengthen universities' ability to contribute to the SDGs.

Sources of further information: http://research.ie/2018/07/18/e4-4-million-to-be-invested-in-21-research-projects-supporting-the-global-sustainable-development-goals/

Source: adapted from Fostering Industrial Talents, published on the Euraxess website, 2017 study for the European Commission's DG RTD.

4.4.5 Possible actions

EU level

Universities' important role in contributing to frontier research should continue to be recognised at an EU policy level and in programme planning in Horizon Europe in 2021-2027.

Whilst national authorities responsible for research and/or higher education have overall responsibility for setting national research funding agendas, the EU could promote greater coordination to ensure closer alignment in these priorities, for instance, by harnessing economies of scale in R&I activities, and ensure that funding is prioritised.

The EU is already supporting pilot actions in Horizon 2020 to experiment with innovative approaches to addressing societal challenges through interdisciplinary research. These could be further built upon, through continued funding support in Horizon Europe. The scope for scaling-up such activities could be considered, as there was a broad consensus that interdisciplinarity in university research should be strengthened.

The European Commission could ensure that EU policy and funding mechanisms strengthen the capacity of those universities wishing to strengthen their contribution to the SDGs. This could be achieved in different ways, such as:

- Broadening participation in the Framework Programmes (FPs) to enable more universities in Europe to contribute to mission-oriented research relevant to the societal challenges. Universities could be supported in widening countries to help overcome the problem of low participation rates in the FPs, so as to catalyse the full potential of universities in this area.
- Recognising the important potential of interdisciplinary research between STEM and SSH in addressing societal challenges, and in delivering societally-relevant research results.
- Strengthening universities' ability to contribute to the implementation of the revitalised ERA through a policy dialogue process between the EU, universities and their representative organisations (e.g. the university networks) to review the ongoing relevance of societal challenges identified in strategic planning processes linked to Horizon Europe. Universities need to be more directly involved in the policy debate as to how societal challenges are evolving, given the accelerated pace of change, and the associated impacts on research needs.
- Cooperation between universities and societal actors both within the EU and in third countries could be supported through funding support to strengthen universities' capacity to work directly with third country stakeholders, especially civil society actors, such as NGOs and CSOs, as well as academia, government and wider sectors. There are already success stories in this regard, e.g. the MSCA CO-FUND intersectoral mobility scheme CAROLINE in Ireland as well as the European Universities Initiative, which is an experiment in this direction.

Possible actions regarding how the EU could help to **generate and reinforce critical research mass** are now outlined:

- At the EU level, the strategic EU policy framework setting out directionality has been in place for a year already. This ought to have a positive structuring effect by enabling universities and broader research actors across the R&I ecosystem to gain earlier foresight as to what the priorities are likely to be supported in the 2021-2027 period. This should better enable universities to identify suitable partners with whom to work collaboratively in advance of research funding opportunities being published (e.g. thematic calls for proposals on topics relating to the societal challenges).

- Looking ahead to Horizon Europe, the EU's proposed excellence initiatives could incorporate three complementary objectives that would benefit universities and the EU (1) scaling up existing activities to support the next generation of excellent R&I networks by creating pan-European knowledge/excellence hubs in strategic areas 2) supporting the institutional development of universities as they seek to become more competitive and advance in areas such as Open Science, interdisciplinarity, and articulating the societal value of science and 3) addressing the research and innovation (R&I) divide in Europe by supporting the best institutions in Widening countries to develop strategies for building on existing scientific and research excellence.[171] The diversity of the EU-13 R&I landscape should be recognised, as it is difficult to generalise as to the extent of support needs across all countries eligible to take part in "widening".
- Whilst fully respecting their autonomy, the EU should encourage universities to prepare strategic research agendas, as presently, not all of them do.
- Challenge-based competitions for collaborative research initiatives should be organised, for instance, to fund research for certain societal challenges that demand an especially quick response (e.g. COVID-19).
- Enhancing critical research mass to contribute to societal challenges by using innovative legal instruments to facilitate cooperation between universities. For instance, innovative and creative legal mechanisms could be identified under Art. 187 TFEU to enable small groups of universities to come together and work collaboratively on research issues of common interest. A case study is presented under 'success stories' which presents examples in this regard.

The EU could strengthen investment in the **EU's crisis mechanism** to respond to pressing societal challenges, such as global health challenges. The Covid-19 pandemic has shown the need to provide a rapid response capability to leverage scientific excellence, research expertise and knowledge from across universities in Europe. Specifically, the EU could support pilot instruments to carry out shorter-cycle research projects able to deliver societally-relevant research that addresses the needs of end-users more quickly. Different types of support could be considered, such as:

- Experimentation through the setting up of pilot schemes using new types of programming instruments within the FPs, that would allow groups of universities to come together and work on a research topic at shorter notice and flexibly.
- A further possibility could be emulating the US model of commissioning research funding through a pre-commercial procurement approach, in which the desired final research outcomes would be specified upfront (e.g. a vaccine and antibody therapies for Covid-19). This approach has been adopted for example under H2020 Space where particular prototypes needed can be specified upfront and procured through contract research agreements.
- Under a pilot scheme, multiple grant awards could be made to different consortia, and it would then be up to competing consortia to pursue different research pathways to reach the specified objectives. This could help to promote breakthrough innovations.

Whilst the above examples are centred on accelerating EU research responses to Covid-19, and considering the role of universities, they could also be suitable for procuring societally-relevant desired research outcomes in a shorter timeframe than would otherwise be possible under the existing FP instruments such as RIAs and CSAs. However, this type of research can be justified at a time of particular crisis (Ebola, Covid-19), as there is a risk that if funding and project selection is knee-jerk, research funding may be wasted unless the criteria of scientific and research excellence are applied. Quality research takes time to mature, and hence, funding agencies take their time in identifying high-quality

[171] This proposed action is well-articulated in a position paper by the Guild, Recommendations for Excellence initiatives (2019), https://www.the-guild.eu/publications/guild-position-on-excellence_intiative.pdf

proposals. Therefore, research to respond to crises is likely to be successful if it is mainly based on long-term basic research.

In a **widening context**, possible solutions to enable universities to participate more fully are the design of better support measures to allow such universities to strengthen their capacity to compete and take part in excellent science programmes, and greater investments from national governments. Piloting new approaches to engage with researchers in widening countries could help to promote more balanced brain circulation, by opening up further opportunities for such researchers to take part in transnational research projects in universities that are presently under-represented in the FPs. For example, newcomers participating in the FPs could be encouraged to participate more extensively in competitive research calls that are related to contributing to the societal challenges.

University level

Fully recognising the autonomy of universities, universities' research agendas will need to consider how universities can build on their distinctive strengths, and where the balance lies between bottom-up, curiosity-driven research and participating in mission-driven research, including in EU funding programmes relating to the societal challenges.

Universities should actively reflect on how to maximise the research impacts of curiosity-driven research to help address *current* societal challenges, and communicate these better to the external world, including citizens, national and EU policy makers. This does not imply losing the longer-term focus of such research, but would rather be a means of extracting additional public value from such research.

Universities should be encouraged where appropriate in future Horizon 2020 and Horizon Europe calls to integrate interdisciplinary expertise where appropriate, as this may strengthen the quality of the proposal and FP projects' implementation. The EU could support interdisciplinarity by recognising its value more explicitly in calls for proposals under the FPs, for example, where this is likely to enhance contributions to the societal challenges.

Universities should recognise interdisciplinary expertise as an asset in researchers' careers.

By 2030, more universities in Europe should be engaged in contributing to the societal challenges, such as climate change and the broader SDGs, through participation in EU-level transnational research. Presently, there is significant under-participation by universities in some Member States, which implies there may be untapped potential, provided that such universities can deliver excellent science, which should not be compromised.

In order to address societal challenges, universities should be able to continue to draw on a range of funding sources, including EU funding (through the FPs, EU Structural Funds), as well as national research funding and own-funding.

By 2030, **universities in Europe will have strengthened close links with local, regional, national and global communities through a trust-based approach.** In light of ever-faster developments in societal challenges, universities will need to review their research agendas, to reflect evolving societal needs.

More universities in Europe could consider the development of a specific research strategy and an action plan at university level towards the SDGs. Although small numbers of universities are already doing this (and are participating in the Times Higher Education

rankings on contributions to the SDGs - see success story example), this would be novel and innovative for many universities.

What constitutes 'societally-driven research' and its ongoing relevance over the short term and the longer-term will evolve over time. A practical means of strengthening linkages between universities and EU policy makers responsible for societal challenges would be to encourage Member States to engage with universities in national and transnational discussions on the prioritisation of societal challenges, such that universities would feed into the debate as to which SC-relevant topics should be supported in Annual Work Programmes (AWPs) under Horizon Europe. The Commission could lead by example, if for instance it could show that it has taken on board universities' feedback and made changes to AWPs (e.g. to specific priorities) as a result.

4.5 TM4: Strengthening human capital in universities and working conditions in universities

4.5.1 Introduction

The mission of universities, in essence, is to create and transmit knowledge, to contribute to the development of their capacity to create, transmit and facilitate the application of such knowledge. When setting a vision for 2030, it thus becomes essential to consider how best to develop the skills and capacity of academics, researchers and doctoral candidates. There is a fundamental error made by many policy makers when discussing the output metrics of research. The focus is always on quantifiable "things" including ideas, theories, discoveries and methods that are represented by publications, patents and education. This ignores the equally if not more important outcome of having highly trained researchers and students with the skills to analyse and solve complex problems. While the funding agencies and research performers can introduce the framework conditions for research that will benefit the economy and society, it is the researchers in universities that will actually achieve the overall objectives of European and national policies, including training a highly-skilled workforce.

Fostering and developing this **human capital** of researchers is a core activity and must be done with a robust career development plan with training that incorporates a variety of areas from leadership to commercialisation. Researchers are at the centre of ERA and Art. 179 as they are the creators of knowledge and through mobility can bring their expertise to other institutions and other sectors. The 2030 generation of researchers need to be practitioners of **Open Science** and be equipped with the skills to work as academics but also to work in wider non-academic areas of employment. Moreover, the university recruitment and career progression process must change to embed the practice of open science and ensure greater intersectoral mobility. This will also require similar changes in the way European and national funding programmes assess researchers.

The question of human capital is very broad and covers all facets of universities. Moreover, questions of human capital overlap with all other issues, including those related to governance, academia-business co-operation and citizen engagement and societal impact. However, the initial literature review and consultations suggest a number of challenges that are common to much of Europe's university sector.

4.5.2 Challenges

Challenge 1: Current systems of evaluating academic's and researchers' careers often risk creating effects that are detrimental to universities role in R&I and to their wider mission.

The system by which professionals are evaluated and rewarded serves as a behavioural driver: incentivising them to prioritise certain activities and outcomes over other activities and outcomes. This can prove highly beneficial, for example, in encouraging the pursuit of

excellence in research. However, two main risks arise: first, that the choice of behaviours/outcomes rewarded are too narrow, leading the academic to neglect other beneficial activities; second, that the choice of metrics applied to the selected outcome is too narrow.[172] For example, an overemphasis on "journal impact factor" risks aggravating the trend towards "less practical, less relevant research and large anonymized data cohorts with tight statistical methods leave little space for practical adoption and impact".[173] A recent survey carried out by the EUA showed that for researcher assessment in over 75% of respondent universities, research publications and securing external research funding are the main criteria.[174] Metrics measuring research output dominate (82%) followed by qualitative peer review at (74%). The main metric for publications is the Journal Impact Factor (JIF) at 75% followed by the h-index at 70%.

Quite a number of universities have signed the DORA declaration,[175] but only a relatively limited few have been introducing practices to move away from metrics-based individual performance measures, e.g. Ghent University[176, 177], UMC Utrecht and Charité University Hospital Berlin.[178] In fact, only 15% of those surveyed by the EUA (2019 above) use DORA as a guiding principle in research assessment.

It should be stressed that not all universities have metrics-based performance measures, reflecting the heterogeneity of universities in Europe, and divergence in their approach to assessing researchers' and academics' careers.

There is evidence from Sweden that high-performing researchers engage in research, commercialisation, and/or public dissemination activities to a higher degree than other academics.[179] However, academics may consider that engaging in these other activities risks imposing a high personal cost, for example, in terms of additional unpaid hours worked or foregoing reward and recognition. This creates the risk of a "one-sided emphasis on research performance, frequently leading to the undervaluation of the other key areas such as education, impact, leadership and (for university medical centres) patient care," as the Vereniging van Universiteiten group argues.[180]

One of the collateral effects of greater focus on research by national governments, reduces the importance of teaching and mentoring. Moreover, in terms of the well-publicised university rankings (THES, Shanghai and QS), the metrics for teaching are based on factors that do not capture to any real extent the quality of teaching (as they include, for example, staff to student ratio and reputation). As a result of these factors, teaching and

[172] EUA (2019), Reflections on University Research Assessment: Key concepts, issues and actors. European University Association. Available at: https://eua.eu/resources/publications/825:reflections-on-university-research-assessment-key-concepts,-issues-and-actors.html
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[174] EUA (2019), Research Assessment in the Transition to Open Science, https://eua.eu/resources/publications/888:research-assessment-in-the-transition-to-open-science.html
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[179] Wigren-Kristoferson, C., Gabrielsson, J., and Kitagawa, F. (2011). Mind the gap and bridge the gap: research excellence and diffusion of academic knowledge in Sweden*; Science and Public Policy*, 38(6), 481-492.
[180] VSNU, NFU, KNAW, NWO and ZonMw. (2019). Room for everyone's talent towards a new balance in the recognition and rewards of academics. Pp. 4. Available at: http://vsnu.nl/recognitionandrewards/wp-content/uploads/2019/11/Position-paper-Room-for-everyone%E2%80%99s-talent.pdf

mentoring is diminished in importance for recruitment and career progression relative to research.

Moreover, some national regulatory frameworks may limit the ability of universities to have an open, transparent and merit-based recruitment process. Indeed, certain funding models may exacerbate the problem, where universities are not always in control of the means to improve incentives in research careers, including improving salaries and tackling precarious contracts as significant levels of research funding come from external sources.

Another factor that impacts negatively on researcher assessment is that of unconscious bias in the context of gender and diversity.[181] It is important to understand that this acts independently of the type of criteria used and needs to be addressed directly at university, national and European levels.

An in-depth study by Science Europe has considered in detail a wide range of aspects on Research Assessment in consultation with its members (funding agencies and research performing organisations across Europe).[182] They have issued a comprehensive set of recommendations in a position statement that addresses all of the issues raised above.[183] It is clear from these recommendations that there will be major positive changes in how national funding agencies across Europe will assess research in the future.

Challenge 2: There is a need to improve the employability of researchers.

Globally, the number of researchers is increasing due to intensifying investment in research and innovation. In the period 2007-2015 the global stock of researchers increased by 21% to a total of 7.8 million[184]. The highest percentage at 22.2% is in Europe with 19.1% in China and 16.9% in the US. With increased investment in research the main areas of expansion are at the R1 (PhD) and R2 (Postdoc) levels, with far smaller increases at R3 and R4. This means that a bottleneck is created where the demand to progress to R3 and R4 (as a university academic) can only be met for a small number of researchers given the limited number of university academic positions; this trend was emphasised by the UK Royal Society.[185] A good example of this over supply is the US, where there can be typically over 70,000 postdoctoral researchers, but only an annual total of 3000 track tenure positions available.[186]

This issue of 'permadocs' is being addressed in a variety of ways globally. In New Zealand, they have simply capped the numbers in order to solve the problem. France has introduced national legislation to limit the postdoctoral period to 6 years.[187] This has also been done within some institutions in Europe (e.g. Ireland and UK) and the United States (e.g. University of California system). However, while this can help set a fixed timeline for a researcher to remain as a postdoc (R2), it does not deal with the core issue of the majority of PhD graduates and postdocs transitioning to jobs outside of academia. Research for the European Commission shows that the majority of EU doctoral candidates will not take up an academic career and thus they need to be better prepared for a wide range of

[181] *Implicit bias in academia: A challenge to the meritocratic principle and to women's careers – And what to do about it*, Advice Paper n23, LERU (2018)
[182] *Science Europe Study on Research Assessment Practices*, Technopolis, December 2019, http://www.scienceeurope.org/media/fmdihoqy/se-study-on-research-assessment-practices-report.pdf
[183] *Recommendations on Research Assessment Processes*, Science Europe July 2020, http://www.scienceeurope.org/media/3twjxim0/se-position-statement-research-assessment-processes.pdf
[184] UNESCO Science Report towards 2030, UNESCO (2015)
[185] The Scientific Century – securing our future prosperity, Royal Society (2010)
[186] "The future of the postdoc", Nature, 520, 7546 (2015)
[187] A time limit on postdoctoral contracts: The French experience, Science Careers, April 2015: http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2015_04_30/caredit.a1500111

careers in non-academic sectors.[188] Researchers are not overqualified, but their contribution to sectors outside academia could be enhanced substantially if their academic training viewed this career option as plan A, not plan B.

The network of Young European Universities identified an awareness of strengths and assets and an investment in broad, research-related skills as essential for young researchers' employability.[189] It is important to understand that researchers with individual grants (e.g. MSCA Individual Fellows) usually have skills training built into their funding. This is not the case for the majority of researchers hired under research projects. They are usually expected to work fulltime on the research with no time or funding for skills training or professional development. This underlines the need for protected time for all researchers to access skills training and professional development.

The need for continuous professional development also applies to more senior researchers and academics (R3 and R4). Grdošić (2018) calls for lifelong learning to be embedded in academics' career paths, so that they are "continuously working on personal development, seeking best ways to train their students necessary skills that will allow them to use technology and information in their learning process".[190]

This underlines the need to continuously improve researchers' skills reflecting in part the fact that career paths are becoming much more "fluid", typically featuring more changes of position or institution than in previous years. Many career paths are likely to feature changes of role/specialism and movement between academia and non-academia[191]. Such fluidity has been caused by short-term funding models but also wider trends in society, such as technological change and job hopping. This means that academia has become the alternative career for researchers.

In order for researchers at all career stages to have wider career opportunities they need access to skills development opportunities. These include digital skills, leadership, commercialisation, open and responsible science skills (including Open Access publication, FAIR and open data management, research integrity and ethics, engagement with society, and the role of Citizen Science in strengthening engagement in Open Science). There is also a need to expose researchers to the non-academic sector, as a way of widening, enhancing and updating skills and experience. This is necessary for researchers to maintain the relevance of their teaching but also because of the likelihood that many will work in the non-academic sector at some point in their careers. This is particularly the case for R2 and R3 researchers who are usually on fixed term contracts and the majority are unlikely to secure long term employment in academia.

Challenge 3: There is a need to increase the inter-sectoral and inter-disciplinary mobility of academics and researchers.

Whilst there remains a need for many academics to work in-depth within their own disciplines, two trends are increasing the need for inter-sectoral and inter-disciplinary mobility amongst researchers: first, the trend towards short-term funding for research positions at R2 and R3 levels in general; this is requiring researchers to change roles within academia or even into and out of other sectors; second, many of the key challenges facing society require solutions that draw on and combine expertise from different academic disciplines and with expertise from non-academic sectors. There is therefore a need to

[188] European Commission (2017) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a renewed EU agenda for higher education. SWD (2017) 164 final. p.9.
[189] YERUN (2020) Food for Careers. YERUN inspirational practices on enhancing Graduate Employability. https://www.yerun.eu/wp-content/uploads/2020/03/YERUN-2020-02-18-Brochure-84p-A4-DEF-Web.pdf
[190] Grdošić, M. (2018), Meaningful Teaching and Training – Higher Education of the Future; in The Future of Universities Thoughtbook, University Industry Innovation Network, 2018
[191] Young researchers thrive in life after academia - Alternative career paths should be celebrated, not seen as a compromise. Nature Editorial, Vol. 537 (2016)

develop a mix of specialist and transversal competences, which typically requires a degree of inter-sectoral and inter-disciplinary mobility, although such mobility will take very different forms and vary across different disciplines.

Additional benefits of such mobility experiences are a higher level of familiarity across sectors and disciplines and an ability to move between them with more agility. At doctoral level (R1), the EUA-CDE calls for the development of transversal or generic skills and competences, in addition to research skills and notes that doctoral schools and similar structures are responding to this need.[192] However this is not widespread as a survey carried out by the European Commission in the MORE3 study showed that while 81% of PhD candidates consider transferable skills training important, only 33% received such training. [193]

At more senior research levels, such mobility is too often disincentivised by systems of evaluating and rewarding academic careers and, as noted by Eckert (2018), a tendency for industry not to honour or recognise academic/scientific sabbaticals or any other "friction" in career paths.[194] Conversely, it can be difficult for researchers from an industry background to secure academic employment. Also, researchers with valuable interdisciplinary experience miss out on career opportunities when senior research positions continue to reflect a silo-approach in a research organisation. Measures addressing challenge 3 therefore will also be connected with challenge 1 and 2.

One of the university networks and also a business representative association were strongly in favour of greater intersectoral mobility, not only of researchers, but equally, of academics, both from a knowledge transfer and a skills development perspective. However, it was recognised that this would demand a cultural shift. A university network that contributed to this study commented that "PhD holders' careers outside of academia continue to be seen as 'second-rate' compared to those who continue to work in the university and this is, in big part, due to the lack of equivalence between the two and, hence, to the fact that the profession of "researcher" is not officially recognised. Conscious that this cultural shift might take longer time to take place, we strongly believe in the need to expose academics as much as possible to the non-academic sector, and to continue to upskill and reskill".

Challenge 4: The internationalisation of research and higher education - geographical mobility and brain circulation.

Universities in Europe are becoming more and more internationalised. This strongly suggests that education and research-driven mobility will increase significantly, although COVID-19 may slow the pace of internationalisation (see later in challenge).

The rationale for promoting the geographical mobility of academics and researchers is that individuals will gain career benefits from international experience, host institutions will gain from the experience and different perspective offered by non-nationals, and innovation will be promoted through the cross-fertilisation of ideas from diverse professionals. For example, a simulation exercise has found that geographical mobility promotes innovation by enabling more heterogeneous groups to work together.[195] Similarly, "real-world" research for the European Commission has found that geographic mobility leads to a higher level of innovation by allocating the innovation potential

[192] European Universities Association Council for Doctoral Education (2019), Doctoral education in Europe today: approaches and institutional structures
[193] Mobility Patterns and Career Paths of EU Researchers (www.more3.eu)
[194] Eckert, N. (2018), "Freedom of Science" or "Freedom from Science"? in The Future of Universities Thoughtbook, University Industry Innovation Network, 2018
[195] Armano, G., Javarone, M.A. The Beneficial Role of Mobility for the Emergence of Innovation. Sci Rep 7, 1781 (2017).

incorporated in individuals to the environment where they can achieve the highest return.[196] Other research for the European Commission has shown that, researchers with international experience tend to exhibit a higher scientific impact.[197] Recent decades have seen substantial progress made in promoting geographical mobility, not least through the EU's Marie Skłodowska-Curie Actions (MSCA). There have been a number of significant initiatives including the Fixed Term Work Directive (1999)[198], the RESAVER[199] European wide researcher pension scheme and the European Researchers Charter and Code of Conduct for their Recruitment[200] that have improved working conditions. The Third Country Researchers Directive (2005) or scientific visa[201] and its update in 2016[202] to include students along with the EURAXESS[203] services have removed significant barriers for internationally mobile researchers.

However, there remain two main barriers to increasing mobility further. First, there are barriers to mobility affecting all professions, for example, relating to issues including social security provision, employment rights and language. Second, there are differences in the employment status of academics in different countries and different national frameworks for recruitment, reward, etc. National regulations may present obstacles to aligning with the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers. Different practices by research funders may result in unequal treatment of researchers (e.g. different salaries for similar work; restrictions by funders to engage in skills training especially at postdoctoral (R2) level).

A university network commented that "a joint approach among different actors is needed to promote education and work-related mobility by developing flexible pathways for international students and professionals, qualifications and lifelong learning, and services to support their integration and employment". One means of achieving this could be to support joint international student recruitment activities and the development of educational and researcher career paths in partnership between universities, industry/ business, and other sectors. The same EU-level network commented that "There is the need for national policy frameworks and regulatory reforms at national level to support this development. For example, the entry of international students and employees needs to be streamlined by allocating sufficient resources to the processing of residence and work permits".

A further issue relates to the potential adverse impacts of increased geographical mobility, notably the "brain drain" away from countries with weaker research sectors towards those with stronger ones, which can be aggravated by differentials in salary levels. For example, within the MSCA, universities in EU-13 countries tend to submit fewer proposals and proposals are on average of lower-quality than those of EU-15 countries.[204] Furthermore, whilst the ERC grants foster scientific and research excellence, they also risk furthering brain drain, as an estimated 90% of portable ERC grants go to Top 20 universities in Europe, as these universities are seen as prestigious by ERC grant holders. [205] Two-thirds

[196] I Z A Research Report No. 19 Geographic Mobility in the European Union: Optimising its Economic and Social Benefits
[197] European Commission. (2017). FP7 ex post and H2020 interim evaluation of Marie Skłodowska-Curie actions. Brussels: DG EAC Available at: https://ec.europa.eu/research/mariecurieactions/sites/mariecurie2/files/interim-evaluation-msca-report.pdf
[198] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A31999L0070
[199] https://www.resaver.eu
[200] https://euraxess.ec.europa.eu/euraxess/charter-code-researchers
[201] European Council (2005) *Procedure for admitting third-country nationals for the purposes of scientific research*, European Council Directive 2005/71/EC (OJ L 289, 3.11.2005)
[202] European Council (2016), *Conditions of entry and residence of third-country nationals for the purposes of research, studies, training, voluntary service, pupil exchange schemes or educational projects and au pairing*, European Parliament and Council Directive EC 2016/801 (OJ L132/21 11.05.2016)
[203] https://euraxess.ec.europa.eu
[204] DG EAC (2017), FP7 ex post and H2020 interim evaluation of Marie Skłodowska-Curie actions
[205] Evaluation of three years of the operations of the ERCEA 2015-2018, 2018-19, CSES and PPMI for the European Commission's DG RTD.

of ERC grantees are also early-stage, young researchers, and therefore, they perceive that their careers will benefit from taking their grant to a leading-edge university. This fosters excellence, but does pose brain drain concerns (e.g. confirmed by YERUN, in the ERCEA evaluation).

One way to promote geographical mobility in a way that does not aggravate problems of "brain drain" could be including mobility already at an early stage in academic careers - not just at the end of positions but within - e.g. short-term secondments/research visits. This could alternatively be achieved through brain circulation of interdisciplinary groups of international researchers, an example coming from the CAT programme of European IAS (Institutes of Advanced Studies).

A major collateral effect of the Covid-19 pandemic has been to bring to the fore the practice of virtual mobility. Many universities are actively planning to provide virtual access to courses for students in the academic year 2020-2021. This type of collaboration has already been accepted practice for researchers in many fields but is not recognised nor taken into account for researcher assessment. Virtual mobility could also provide equal access to and for researchers with physical disabilities, would help those on parental leave to maintain contact with their national and international networks. Provided high-speed internet is available, it would also enable researchers in the widening countries to access well-resourced labs and to collaborate internationally[206]. Combined with short term secondments/visits, this could go some way towards improving the retention of researchers in those widening countries. This would then expand the concept of triple-i mobility (international, intersectoral and interdisciplinary) to quadruple-i mobility (international, virtual, intersectoral and interdisciplinary).

In summary, the challenges are ensuring that:

- the **quality** of mobility experiences improves (fewer administrative and regulatory barriers);
- the **benefit** of mobility experiences improves (recognition in career progression; possibility to retain researchers after student visa expires), and that;
- the **negative consequences** of mobility are addressed (brain drain).

Challenge 5 – the need to integrate inclusiveness into human capital:

Diverse learning and research environments are crucial for preparing students and researchers for working in an increasingly diverse and demographically changing society.[207] The EU is committed to advancing gender equality and gender mainstreaming in the area of research and innovation, which is one of the key priorities of the European Research Area[208] and an objective and legal obligation under the EU framework programme for research and innovation.[209]

There is still a gender gap in research positions and documented "glass ceiling" for women progressing through their academic careers beyond the doctoral level, with a persistent under-representation of women in the highest grades and research posts and as heads of academic institutions.[210] These gaps become even more pronounced when other

[206] O'Carroll C., et al. Virtual Mobility can drive equality, Nature Correspondence, 511 292 (2014)
[207] Council of Graduate Schools, 2009, 'Building An Inclusive Graduate Community: A statement of principles' (CGS): http://cgsnet.org/ckfinder/userfiles/files/Inclusiveness_Resolution.pdf
[208] European Commission: Gender Equality Strategy 2020-2025 https://ec.europa.eu/info/policies/justice-and-fundamental-rights/gender-equality/gender-equality-strategy_en
[209] https://www.scienceeurope.org/our-priorities/eu-framework-programmes/
[210] European Commission: She figures 2018 https://op.europa.eu/en/publication-detail/-/publication/9540ffa1-4478-11e9-a8ed-01aa75ed71a1/language-en

characteristics are also considered, such as race / ethnicity, disability, or socio-economic status.

This is problematic not only from an equality perspective, but also considering that Member States are threatened by brain-drain[211] and competing for research talent to foster pipelines of talented researchers.

There are also still stark differences between Member States. In 2018, the European Research Area and Innovation Committee (ERAC) analysed the ways in which Member States implemented the 2015 Council Conclusions of 2015 on Advancing Gender Equality in the European Research Area[212] and found that while significant steps had been made in several Member States and their research funding organisations, significant gaps persisted between higher and lower innovation countries. The latter tended to have a lower gender equality index and fewer actions and strategies to promote gender equality in research compared to higher innovation countries. Recommendations from this report include stepping up actions in lower innovation countries and focussing on monitoring and evaluation of gender equality policies in higher innovation countries, specifically:

- sex-disaggregated statistical data collection and monitoring
- gender/diversity bias training for staff and research evaluators
- gender/diversity experts and observers on evaluation panels
- formalisation and transparency of the evaluation process
- gender/diversity balance on evaluation panels
- double-blind review process
- gender mainstreaming of funding programmes, particularly eligibility rules and evaluation criteria
- Open Science
- gender proofing of language of call texts

4.5.3 Transformation needs

The 2030 Vision does not require the adoption of uniform approaches to strengthening academic and researcher talent. However, there is a need for the way that the skills and capacity of researchers and academics at all career stages (R1-R4) are developed to ensure that universities fulfil their core roles in education and research and develop and transmit the knowledge required to address complex global challenges. The need is for a transformation of Europe's university sector so that:

- Excellence will be well-rewarded in all areas of academic life, including research, a culture of sharing results, teaching, leadership, entrepreneurship and societal engagement.
- Researchers will have access to a wide range of skills development opportunities that will allow them to create an individual career plan that can be a pathway to a wide range of professions; from academia to entrepreneurship, for example.
- Academic professionals will be supported to continuously update their skills (lifelong learning) and knowledge in line with developments for evolving R&I needs including digital and soft skills for researchers & innovators, e.g., for intersectoral mobility.

[211] European Commission (2019) Impact of Brain Drain – EU demographic scenarios: https://ec.europa.eu/jrc/en/facts4eufuture/eu-demographic-scenarios/impact-brain-drain
[212] ERAC Standing Working Group on Gender in Research and Innovation (2018) Report on the implementation of Council Conclusions of 1 December 2015 on Advancing Gender Equality in the European Research Area: https://data.consilium.europa.eu/doc/document/ST-1213-2018-INIT/en/pdf

- The full range of a researcher's attributes and competences will be recognized and taken into account for recruitment, career progression and funding allocation.
- Researcher assessment will recognise quadruple mobility (international, intersectoral, interdisciplinary and virtual).
- Talent will circulate widely and in a balanced way.

4.5.4 Case studies and success stories

The first example focuses on reform of national frameworks for assessment, development and promotion, and draws on an example from the Netherlands.

Reform of national frameworks for assessment, development and promotion

Implementer: The main public funders of research in the Netherlands (VSNU, NFU, KNAW, NWO and ZonMw).

Objectives: Reform national frameworks for the assessment, development and promotion of academics.

Description of activities: The main public funders of research in the Netherlands are planning to introduce a new national framework for assessment, development and promotion in 2021, namely a recalibrated "University Job Classification System" (UFO). Each institution will introduce

- institution-wide committees to create support for the new system and involve the target groups in the process;
- institution-specific assessment criteria and narratives based on the national framework for all key areas and team achievements;
- programmes to stimulate and supervise academics in their career;
- courses on academic leadership in education, research, impact and (in university medical centres) patient care;
- doctoral programme criteria meeting the DORA principles.

In parallel, the same bodies are also revising the way that research proposals are assessed in order to support the diversification of career paths. New funding instruments will recognise and promote diversity in research and in researchers and also place greater emphasis on team science and inter-disciplinary collaboration. The Standard Evaluation Protocol (SEP) used to evaluate research units, will place greater emphasis on societal impact, open science, diversity and talent policy.

Key achievements / lessons learned: This initiative shows the possibility for change through collaboration amongst key players in R&I funding at the national level.

Replicability / transferability potential: Whilst the reformed national frameworks are designed specifically for the Netherlands' context, the principles and the overall approach offer the potential to be replicated in other EU Member States, albeit after appropriate customisation.

Sources of further information: VSNU, NFU, KNAW, NWO and ZonMw (2019), Room for everyone's talent towards a new balance in the recognition and rewards of academics:

https://www.vsnu.nl/recognitionandrewards

The following example was provided by one of the university consortia taking part in the Erasmus+ funded European Universities Initiative.

Researchers Mobility Fund

Implementer: The European Consortium of Innovative Universities (ECIU).

Researchers Mobility Fund
Objectives: Promote international mobility of researchers **Description of activities:** ECIU operates a Researchers Mobility Fund which provides grant of up to €5,000 for early career researchers. The funding is primarily for travel and subsistence costs related to international research collaborations within the ECIU. **Key achievements / lessons learned:** As well as benefiting individual researchers, the grants are also to supporting the achievement of clear research goals and promoting long-term collaborations between the sending and host universities. ECIU also offers a Staff Mobility Programme for administrative support staff to spend time at other ECIU institutions. **Replicability / transferability potential:** The fund would be replicable by any similar transnational consortium of universities operating in research and innovation. **Sources of further information:** https://www.eciu.org/for-staff/researchers-mobility-fund

A further example was provided by YERUN and is set out below. The scheme promotes mobility through placements which take place among universities. Sometimes, it also includes research centres (or other associated institutions) from among YERUN's member universities. The principal idea behind this award is to promote changes in the career assessment of researchers to include qualitative indicators.

It should be noted that a further example of intersectoral mobility encouraging cooperation with other sectors beyond business is provided in TM5 (fostering cooperation with other sectors). Evidently, intersectoral researcher mobility is relevant to both TM4 (human capital) and TM5.

The YERUN Research Mobility Award
The YERUN Research Mobility Award (RMA) is an example of using new indicators to evaluate and reward researcher mobility. Since 2017, YERUN has been running a research mobility grant scheme called "YERUN Research Mobility Awards". The YERUN Research Mobility Awards (YRMA) are competitive awards for PhD students, post-doc and early career researchers, equivalent to Euraxess Research Profiles R1 (up to the point of PhD) and R2 (PhD holders, post-doc or equivalent who are not yet fully independent or until 8 years since completion of PhD) from YERUN Universities*. The programme provides support (a grant of 1,000 Euros) for researchers to undertake a minimum of 1-week stay at one YERUN partner institutions from a different country. The programme provides a platform to: • work with other YERUN academics on a research project, publication, or new collaborative activity; • promote multi-disciplinary research across the YERUN network; • enrich the research and training opportunities for PhD students, early career and postdoctoral scholars within the YERUN network. The YERUN RMA is currently entering its third round. By the end of 2020, more than 100 researchers will have visited YERUN partner universities to establish new lines of research collaboration. Since the second call, the RMA focuses on researchers in an early stage of their career (R1 and R2). Early career researchers (ECRs) are still in the process of building their international research networks. They are especially curious to explore the YERUN partner universities and use the possibilities the YERUN offers to them to advance their research and expand their network. Thus, for the RMA we are looking for promising talents with great research ideas who are excited to advance research, tackle societal challenges, and build bridges between the network's institutions.

In the area of gender equality in R&I, some good practices are worth highlighting at the national level, as per the following box:

Example of efforts to integrate gender equality in R&I

- ERA National Action Plans and Strategies have been adopted by eight Member States in response to the 2015 Council Conclusions, which was often the first policy document to address gender equality in research at national level.[213]
- Introduction of the Gender Equality in Academia and Research (GEAR) tool to provide universities and research institutions with practical advice and tools through all stages of institutional change, from setting up a gender plan to evaluating its real impact.[214]

Actions at the national level include, for example, **Sweden**, where gender equality is among the main priorities in research policy through the mainstreaming of gender equality in national research funding programmes[215]; the **Netherlands**, which included measures such as a national programme supporting female academics, and through the labour law to include more employees with a disability in the workplace, which includes universities[216]

Further good practices can be identified at an institutional level, e.g. **TU Delft (Netherlands):** The HR strategy at TU Delft is aimed at attracting a diverse pool of talent to ensure diverse talent in the future and reflect the diversity of society to find solutions for societal problems. Actions include the creation of a post of diversity officer, a diversity and inclusion team whose work is mainstreamed throughout the university and has an advisory role towards the executive board of the university, and exchanges knowledge and expertise with other Dutch universities and with universities from other European countries through networks such as CESAER (Conference of European Schools for Advanced Engineering Education and Research).[217]

4.5.5 Possible actions

The actions listed below should be seen as a means to enable universities to raise levels of research and teaching excellence through the support of researchers. Universities and policy makers may identify complementary actions that can help them to better support researchers.

EU level

- Regulatory instruments: there is a need to consider what regulatory reforms can be introduced that could support the free circulation of academics and researchers, e.g. based on Treaty articles on citizenship (articles 20, 21) or free movement (45, 53). Regulatory reforms, including a Framework Directive, might address difficult issues that affect most, if not all, sectors of the labour market, for example, relating to social security provision or pension rights.
- EU funding programmes (including Horizon Europe and the ESIF) could continue to promote geographic mobility and the enhancement of the employability of academics and researchers. Furthermore, compliance with EU charters and codes of conduct relating to the recruitment of researchers could also be made a condition for receiving funding. ESIF funding could be used to support the mobility of researchers to widening countries to encourage the balanced circulation of talent within Europe.

[213] https://era.gv.at/object/document/2763
[214] https://eige.europa.eu/gender-mainstreaming/toolkits/gear
[215] Swedish Higher Education Council (2016) Can Excellence Be Achieved In Homogeneous Student Groups? A report on the governmental assignment to survey and analyse the work of Swedish higher education institutions on widening access and widening participation. https://www.uhr.se/publikationer/Rapporter/can-excellence-be-achieved/
[216] https://feminer.nl/de-westerdijk-talent-impuls-onder-de-loep/; https://www.rijksoverheid.nl/onderwerpen/participatiewet
[217] Neuteboom, M. (2018) Diversity for Excellence and Innovation in Science, Engineering and Design at the Technical University of Delft; in: Claeys-Kulik, A. and Jorgensen Ekman, T. (eds.) (2018) Universities' Strategies and Approaches towards Diversity, Equity and Inclusion. Examples from across Europe; pp. 25-30 https://eua.eu/downloads/publications/universities-39-strategies-and-approaches-towards-diversity-equity-and-inclusion.pdf

- Funding: Support for pilot projects that develop new approaches to evaluating academic performance and to developing staff employability.
- Policy tools: an enhancement of EU support for the mutual recognition of qualifications might also enhance mobility and the development of talent generally.
- EU policy instruments could promote wider transformation of national frameworks, using EU funding programmes and various soft instruments as a "lever" to promote open, transparent and merit-based recruitment process and recognition for engagement in non-academic work.
- Open method of co-ordination to strengthen national policies/frameworks, in particular to promote and co-ordinate a broader assessment system of research and researchers (more qualitative assessment, rewarding excellent science and open science practices, engagement in non-academic, etc.) and also to promote alignment with the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers.
- Renewed European Charter for Researchers that takes into account explicitly gender, diversity, Open Science, innovation, research integrity, Citizen Science, quadruple - mobility (international, intersectoral, interdisciplinary and virtual), and evaluation in career development. There are a number of ways that this could be achieved, namely,

  1. Replace the 40 Principles in the current European Charter for Researchers taking into account developments since 2005 (when the Charter was published).

  2. Retain the current set of Principles and add new ones to reflect the changes in EU policy and practice since 2005

  3. Make a clear distinction between the "Charter" and "Code". Make the Charter a legally binding document on the rights and responsibilities of researchers and employers/funders of researchers. Introduce voluntary/mandatory Codes of Conduct under different thematic headings including Gender & Diversity, Research Integrity, Open Science and Recruitment.

- Renewed Code of Conduct for the Recruitment of Researchers to include an inclusive and broader assessment of track record, skills and potential to address implicit bias in recruitment as well as career development. Whilst there could be an ongoing focus on ensuring high-quality research as the most important factor in recruitment it would be based on wider criteria than narrow bibliometrics. In addition, other criteria could also be considered, and appropriately weighted for the relevant position in terms of researcher career level. Taking the Open Science Career Assessment Matrix (OS-CAM) and appropriately weighted for the relevant position R1-R4, this could include:
  - Research Output
  - Research Process (including stakeholder engagement/Citizen Science, collaboration and interdisciplinarity and research integrity)
  - Service and Leadership
  - Research Impact (including communication & dissemination, IP exploitation and open knowledge exchange with non-academic partners)
  - Teaching and Supervision
  - Professional Experience
- Piloting a broadened researcher career assessment in Horizon Europe funding programmes led by good practice in the ERC and the MSCA. In contrast to other actions in the Framework Programmes, both of these programmes focus almost exclusively on research excellence and researcher career development.

- New Codes of Conduct for Gender, Open Science, Research Integrity and Citizen Science following, or being integrated in the current Code of Conduct for the Recruitment of Researchers.
- Requiring all researchers employed (or as PhD students R1) on EU funding stream contracts to have protected time, up to 10%, for example. This would include the acquisition of new skills, time to pursue own research interests (independent of their funded project) and future career opportunities. It would be difficult to dedicate more time than this as PhD students already have to teach, publish and ideally do civic engagement while keeping to a 3-4 year maximum.
- Expansion of EURAXESS services to provide skills training at regional and national level for researchers (R1-R4). Even if not all universities in all Member States actively use EURAXESS services, with over 600 support centres, many based in universities, these are in demand in some EU Member States, especially many of the widening countries in the EU13, Spain and in Ireland.
- Actions at EU level to include the European tertiary education register (ETER)[218], a project which started in August 2013, and aimed at building a complete register of HEIs in Europe, providing comparable data on the number of students, graduates, international doctorates, staff, fields of study, income and expenditure as well as descriptive information on their characteristics, with a breakdown by gender for most variables.
- Within the EU Horizon 2020 programme, the Marie Sklodowska-Curie actions (MSCA) for training and career development of researchers are widely regarded as best practice in promoting gender balance, with nearly 40% of fellows who are women (a share that is significantly higher than the European average).[219]

National level

- At national level, there is a need to modernise regulatory and policy frameworks and also to consider how funding can be used in support of transformation. This could include increasing access to professional career development support and skills training for researchers at all career stages and training on digital and open science skills.
- Research funding agencies could ensure that all the researchers they fund are given protected time for skills training and professional development.
- Adequate salaries and attractive working conditions for researchers need improvement in a number of EU countries.
- National funding agencies should adopt mechanisms of research evaluation that focus on quality rather than quantity in researcher assessment and take into account other aspects including quadruple mobility. This could be achieved by implementing the Science Europe recommendations on Research Assessment[220].

Universities

- A wider adoption of the HR Excellence in Research Strategy as a quality framework for recruitment and career development can embed HR-related changes within an institutional management strategy.
- Embed the OS-CAM approach to researcher assessment in recruitment and career progression.

[218] http://eter.joanneum.at/imdas-eter/
[219] https://www.mariecuriealumni.eu/news/marie-sk%C5%82odowska-curie-actions-support-100-000-excellent-researchers-strong-focus-boosting
[220] *Recommendations on Research Assessment Processes*, Science Europe July 2020, http://www.scienceeurope.org/media/3twjxim0/se-position-statement-research-assessment-processes.pdf

- Making use of legal entities such as "European Grouping for Territorial Co-operation" (EGTC) by universities or consortia of universities that could serve to promote the geographical mobility of researchers. It would be up to universities to determine whether having a legal entity that allows them to pursue transnational cooperation is appropriate or not. Where such entities involve non-academic bodies, this could also promote greater inter-disciplinary and intersectoral mobility.
- Within universities, there is a need to align institutional practice with the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers and to implement an assessment system of research and researchers of a more qualitative nature, that rewards excellent science, and notably the practice of open science.
- Individual universities could give consideration to integrating gender equality and inclusiveness and diversity in their HR strategies. Consideration could be given for example to structuring intersectoral mobility programmes in a way that is family-friendly.
- Consortia of universities could create programmes to support transnational mobility of researchers between their member institutions, with a particular focus given to inter-sectoral mobility.
- Individual universities can adopt alternative mechanisms of research evaluation.

4.6 TM5: Fostering increased knowledge transfer and collaboration between academia and non-academic sectors

4.6.1 Introduction

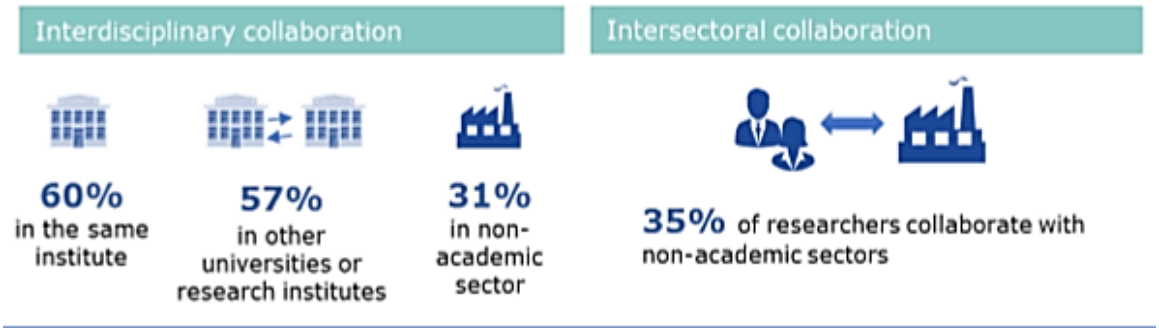
Universities have a unique, multi-faceted role within research and innovation ecosystems and society, whether in providing a talent pool to work in research within academia and in other sectors, bringing new technologies to the market, improving public services or in addressing societal challenges. These different functions require universities to engage with other sectors.

Many universities across Europe are already actively engaging with other sectors, in some cases for several decades. However, the nature and scope of such cooperation is a moving picture as the wider ecosystem of which universities form a part is constantly evolving. Therefore, there remains scope to further consolidate and strengthen cooperation between universities in Europe and other sectors. This module considers how universities could be enabled to strengthen and better structure their existing connections with other sectors. Universities operate in a wide socio-economic context and "innovation ecosystem".[221] The majority of universities already interact with a broad set of different stakeholders from industry and business, the public sector and the non-profit sector/ third-sector. In addition, universities' interactions with society more broadly, through citizen and societal engagement initiatives in the R&I field are considered.

The series of MORE studies have considered the extent of interdisciplinary collaboration and intersectoral collaboration by university-level researchers. Whilst the survey data relates to individual researchers rather than universities as institutions, it can nonetheless be considered as an interesting proxy for the level of collaboration with other sectors.

[221] "An innovation ecosystem is the evolving set of actors, activities, and artefacts, and the institutions and relations, including complementarity and substitute relations, that are important for the innovative performance of an actor or a population of actors." Granstrand, O. and Holgersson, M. (2019). Innovation ecosystems: A conceptual review and a new definition. *Technovation*. Volume 10. Nov 26. pp. 1.

Figure 4-1 - MORE 3 study – interdisciplinary collaboration and intersectoral collaboration by researchers



Source: MORE 3 study for Commission's DG RTD by IDEA, Technopolis and WIFO

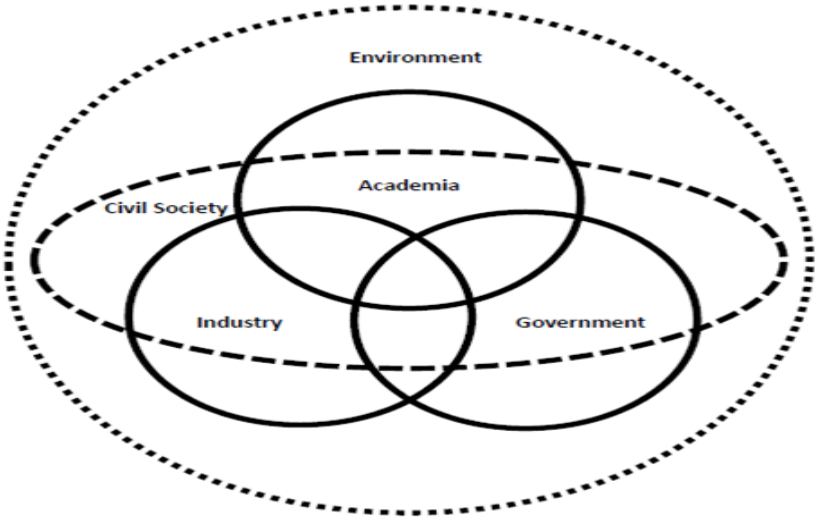
Strengthening interdisciplinary and intersectoral cooperation could be achieved, for example, by improving the structuring and institutionalisation of such cooperation,[222] ensuring that there are intermediaries in place within universities to help facilitate and structure knowledge-sharing, networking and cooperation with other sectors. In a widening country context, some universities have already made significant progress in fostering cooperation between academia and non-academic sectors at an institutional level. However, others lag behind, and presently only pursue such cooperation on an *ad hoc* basis, often depending on the personal dedication of individual academics. The extent of engagement with specific sectors does depend on a university's missions, and the degree of priority given to different missions. This factor varies greatly given the heterogeneity of the European university landscape.

The wider backdrop to co-operation between academia and non-academic sectors is the evolution from a **triple helix model of innovation**[223] (Etzkowitz & Leydesdorff, 1995 and 2000) to a **quadruple and quintuple helix model.** [224] This model encompasses a strong societal focus, i.e. science, policy, industry and users/representatives from societal actors, such as civil society, NGOs, and EU citizens engaged in Citizen Science (TM3 on an EU research and innovation agenda and how universities might best contribute to addressing the societal challenges not only through taking part in mission-oriented research, but also the role of bottom-up, fundamental research in contributing to these, and TM6 on open science).[225]

An example of such a model for tackling climate change[226] is provided below:

[222] Ankrah, S. & Omar, A. T. (2017). Universities—industry collaboration: A systematic review. *Scandinavian Journal of Management.* 31(3), 387-408. 10.1016/j.scaman.2015.02.003.
[223] The triple helix model refers to interactions between academia, industry and government, to foster economic and social development, in the knowledge economy and societal context. See Etzkowitz, H. and Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. Research policy, 29(2), 109-123.
[224] The quadruple and quintuple innovation helix framework describes university-industry-government-public-environment interactions within a knowledge economy. Schütz, F., Heidingsfelder, M.L. and Schraudner, M. (2019). Co-shaping the Future in Quadruple Helix Innovation Systems: Uncovering Public Preferences toward Participatory Research and Innovation. *She Ji: The Journal of Design, Economics, and Innovation,* 5(2), 128-146.
[225] Hasche, N., Höglund, L. and Linton, G., (2019). Quadruple helix as a network of relationships: creating value within a Swedish regional innovation system. *Journal of Small Business & Entrepreneurship*, 1-22.
[226] Carayannis, Elias G., Barth, Thorsten D., Campbell, David F. J. (2012). "The Quintuple Helix innovation model: global warming as a challenge and driver for innovation". Journal of Innovation and Entrepreneurship. 1(1), 1-12. doi:10.1186/2192-5372-1-2.

Figure 4-2 - Role of quintuple helix model in addressing societal challenges (example – climate change): leveraging the knowledge of different stakeholders



Source: Carayannis et al (2012): "The Quintuple Helix innovation model: global warming as a challenge and driver for innovation".

Intersectoral cooperation is also a means of facilitating knowledge transfer, as well as the dissemination and uptake of knowledge generated by universities to other sectors (and vice versa). This can include fostering universities' links to knowledge clusters and innovation networks within regional innovation ecosystems (Carayannis, Campbell, 2012).[227] Promotion of this model of research and innovation has underpinned the European Commission's Responsible Research and Innovation (RRI) policy.

Different forms of cooperation and the extent of interactions between universities and different sectors are now considered.

4.6.1.1 University-business cooperation (UBC)

University-business cooperation (UBC) refers to the interaction between universities, business and industry to encourage knowledge and technology exchange.[228, 229, 230] As such, it concerns strengthening cooperation and the strategic links between business and academia for their mutual benefit and of society in general.

Regarding drivers of academia-business cooperation, firstly, universities might co-operate with businesses to generate and exploit the types of knowledge and innovations relevant to business and society in general. Secondly, a key motivation for such cooperation is that universities produce fundamental research that is complementary to the more applied knowledge generated by businesses. Moreover, businesses do not have the funding to invest in longer-term, bottom-up research, especially given the high level of risk, and the fact that there are uncertain outcomes.

[227] Carayannis, Elias G., Barth, Thorsten D., Campbell, David F. J. (2012). "The Quintuple Helix innovation model: global warming as a challenge and driver for innovation". *Journal of Innovation and Entrepreneurship*. 1(1), 1-12.
[228] Al-Tabbaa, O. and Ankrah, S., (2016). Social capital to facilitate 'engineered' university–industry collaboration for technology transfer: A dynamic perspective. *Technological Forecasting and Social Change*, 104, 1-15.
[229] Bekkers, R. and Freitas, I.M.B. (2008). Analysing knowledge transfer channels between universities and industry: To what degree do sectors also matter? *Research policy*, 37(10), 1837-1853.
[230] Siegel, D.S., Waldman, D.A., Atwater, L.E. and Link, A.N. (2003). Commercial knowledge transfers from universities to firms: improving the effectiveness of university–industry collaboration. The Journal of High Technology Management Research, 14(1), 111-133.

Promoting academia-business cooperation can take several forms, depending on the objectives and priorities of both sectors and the national, regional and local contexts. For instance, co-operation between universities and industry (including individual businesses) takes place at a strategic level, as many industry sectors recognise the benefits of cultivating strategic relationships with universities, which generate industrial talents.[231] Cooperation is also often linked to fostering intersectoral researcher mobility, which is more frequently from academia to industry, but some Fellowship schemes are bi-directional. The role of industrial PhD schemes should also be mentioned as these are a key driver of UBC relationships. In addition, some universities might themselves promote entrepreneurship through entrepreneurship education and training, which typically involves close interactions with the business world. Some universities are also co-located with industry, for instance when there are business and technology incubators located at or adjacent to university campuses. Some universities have moreover established fully-fledged science and technology parks, which provides an effective knowledge transfer mechanism to catalyse university-produced knowledge and innovations.

Regarding the state of play in UBC in Europe, a study for DG EAC (2017)[232] found that UBC has been considerably strengthened over time, especially in comparison with a predecessor Commission study undertaken in 2010-11. *"HEIs are being increasingly seen as a source of talent, entrepreneurship and a lead player in regional development".* However, as will be shown under the challenges, such cooperation is not universal, as many widening countries are lagging behind.

In a lifelong learning context, entrepreneurship could be seen as a key transversal competence relevant to all researchers regardless of whether they are interested in setting up a business. Developing an entrepreneurial mind-set, competences and skills have increasingly been seen as important, for instance as part of under-graduate and postgraduate courses.[233] Academic research confirms developments in this direction. "*Universities are introducing entrepreneurship modules into their undergraduate and graduate curricula with the mission to stimulate entrepreneurial thinking and support the next generation of entrepreneurs" (Fayolle et al. 2006).*[234] However, a key finding from some previous studies was that entrepreneurship training is only sometimes present within PhD and mobility fellowship schemes. Indeed, some researchers and universities do not see such training as essential if the researchers concerned have a strong focus on pursuing a university-based researcher and/ or academic career.[235]

Universities might need more appropriate internal structures to become entrepreneurial themselves, for instance by empowering interested academics and researchers to start their own business, through schemes to encourage university spin-offs and support for business and technology incubators, sometimes co-located. Technology Transfer Offices (TTOs) within universities are relatively common in many, but not all European countries. These provide a structured support mechanism to facilitate the management and exploitation of research outcomes generated through university research activities through

[231] See Study on Fostering Industrial Talents, European Commission, DG RTD, 2018 - https://euraxess.ec.europa.eu/node/5771/#document-collapsible-mobility-fostering-industrial-talents-in-research-at-european-level

[232] The state of university-business cooperation in Europe, Authors: Prof. Dr. Todd Davey, Arno Meerman, Dr. Victoria Galan Muros, Balzhan Orazbayeva and Prof. Dr. Thomas Baaken. https://www.ub-cooperation.eu/pdf/final_report2017.pdf

[233] An example of embedding these types of courses in universities' study programmes can be seen in the University of Bremen's Chair in Small Business and Entrepreneurship (LEMEX) https://www.uni-bremen.de/en/lemex/

[234] Teaching science and technology PhD students
in entrepreneurship-potential learning opportunities and outcomes, Magnus Klofsten, Dylan Jones-Evans and Luciana Pereira, The Journal of Technology Transfer, 2020, https://doi.org/10.1007/s10961-020-09784-8

[235] Study on Fostering Industrial Talents in Research at European Level, study for DG RTD, 2018 https://euraxess.ec.europa.eu/euraxess/news/study-fostering-industrial-talents-research-european-level

IPR where appropriate, whilst on other occasions sharing knowledge openly for the common benefit of society.

To fully exploit such interaction, the integration of universities into local, regional, national, European and sometimes also global innovation ecosystems is fundamental. Certain efforts in this direction have clearly shown the positive societal impact of universities being deeply integrated into innovation ecosystems.[236] Examples are the EIT's Knowledge Innovation Communities (KICs), the Knowledge Integration Communities from Cambridge University and MIT, and the EUTOPIA postdoctoral programmes).

The role of EU funding programmes in promoting entrepreneurship among young people and in universities should also be stressed across a variety of programmes (e.g. the MSCA, Erasmus for Young Entrepreneurs, EASME's SME Associate Pilot, and the activities of the KICs funded through the EIT). Among these, the MSCA, the EIT and the KICs are most relevant to university researchers. For example, a study on the impact of business participation and entrepreneurship through the MSCA revealed many positive impacts of business participation in the MSCA on the career development of fellows, participating organisations, and on strengthening the overall R&I ecosystem at a European level. [237]

Looking ahead to 2030, a 2017 study on the *Future of University-Business Cooperation* found that *"UBC is expected to grow particularly in economically weaker regions, and outside of the technical faculties".*[238] The study highlights a number of policies that could be conducive to fostering UBC. These include *inter alia:*

- Developing programmes to facilitate staff mobility between HEI and business;
- Optimising the structure of the HEI sector to stimulate UBC;
- Developing a regulatory framework to support partnering;
- Supporting entrepreneurial initiatives;
- Developing an ecosystem conducive to UBC;
- Developing incentive systems for HEI and businesses;
- Providing seed money for start-ups; and
- Optimising university funding models to stimulate UBC.

4.6.1.2 Cooperation between universities, public service providers and third sector organisations

Cooperation with the public sector and third sector is likely to increase in importance between now and 2030. Innovation is not confined to technological innovation and to co-operation with industry, but can often be driven by co-operation between academia, public service providers and not-for-profit bodies. Moreover, the evolution towards a quadruple (or quintuple) helix model has reinforced the importance of universities engaging with

[236] The EIT has published a report about the socio-economic impact in Europe of the KICs after the first 6 years of activity. They achieved a greater integration between education, research and business, which was immediately followed by strong growth patterns in knowledge transfer output, incubated business ideas, new products and services, and start-up creation. As each of the KICs addresses a different societal challenge, they helped to develop many societally-relevant concepts going to market, implying greater societal impact in the coming years. The report is available at this page; last accessed on 4 June 2020.
[237] PPMI(2017).Study of business participation and entrepreneurship in the Marie Skłodowska-Curie actions. Available at: https://op.europa.eu/en/publication-detail/-/publication/decfab92-5ae2-11e7-954d-01aa75ed71a1/language-en
[238] Davey, Todd & Plewa, Carolin & Orazbayeva, Balzhan & Galan-Muros, Victoria. (2017). The Future of University-Business Cooperation.

third sector actors, such as NGOs, and community-based organisations (CBOs), which influence civil society and may help to address the societal challenges.

Existing engagement and collaboration between universities and third-sector organisations is especially important as regards the Social Innovation (SI) dimension (see challenge 4 below).

Some universities are already deeply involved in their local R&I ecosystems and have formalised their role and relationship with a combination of public, private, not-for-profit and civil society stakeholders as part of the process of embedding within ecosystems. An interesting example is the Coimbra Group of Universities[239] that have signed a formal declaration, the '**Poitiers Declaration**,[240] which provides a framework for cooperation between universities, city and municipal authorities and other sectors in an urban environment and city-based context. The initiative is supported by 40 universities that belong to the Coimbra Group, and which are based in urban city settings. These universities have vowed to develop close relationships with their surrounding urban ecosystem with a view to affecting socio-economic development, cultural and civic life and urban policy.

There are many examples of successful university-city partnerships which aim to engage in social dialogue with policy makers and other relevant stakeholders from all sectors. A case study on the role of the declaration in providing a framework for cooperation is provided in Section 4.6.4.

4.6.1.3 Citizen and societal engagement

Some universities, and their researchers, may question how they can benefit from engaging with society, as they may perceive the exercise as being costly or superfluous. However, this approach is derived from a worldview that separates science from society. Moreover, while some academic disciplines have a history of collaborating with society to produce excellent research, others have only recently recognised the need to do so. Now more than ever in the context of a gradual erosion of public trust in science (as discussed in TM2), it is imperative that all universities actively engage with society. Many institutions have recognised this (as delineated in the Success Stories below).

Citizen Science has the potential to not only bridge societal divides, but also to open up new and emerging forms of science that would not be possible without active citizen participation. Indeed, "the challenge for national governments, and to a lesser degree, universities, will be to attract and retain talent and thereby maintain their competitive edge in the knowledge society" a key recruitment strategy should be to demonstrate to members of society, of all ages, how they can both benefit from and participate in academic research.[241]

Universities can develop relationships and strengthen trust between science and society, two-way science-society literacy, and an ethos of valuing and acting upon a scientific

[239] The Coimbra Group of Universities (https://www.coimbra-group.eu/) , founded in 1985, is an association of 40 long-established European comprehensive, multidisciplinary universities of high international standard committed to creating special academic and cultural ties in order to promote, for the benefits of its members, internationalisation, academic collaboration, excellence in learning and research, and service to society. It is also the purpose of the Group to influence European education and research policy and to develop best practice through the mutual exchange of experience.

[240] The Poitiers Declaration was initiated in June 2016 in collaboration between Alain Claeys, Mayor of Poitiers and the Rector of the University of Poitiers, Yves Jean. The Declaration reaffirms the central role that Universities play in the development of Cities, with Cities providing a fundamental framework, functioning as a catalyst for the development of Universities. See https://www.coimbra-group.eu/wp-content/uploads/Poitiers-Declaration-signed-9-June-2016-1.pdf

[241] Davey, T., Meerman, A., Orazbayeva, B., Redel, M., Galán-Muroz, V., Plewa, C., and Eckert, N. (2018). *The Future of Universities Thoughtbook*. Amsterdam: University Industry Innovation Network.

evidence base. The primary objective of involving citizens in academic research is to improve the relevance and excellence of research, but a secondary outcome of this activity is stimulating interest in the public and encouraging citizens to keep apprised on the empirical research conducted at academic institutions.[242]

4.6.2 Challenges

Before setting out the specific challenges regarding cooperation between universities and different sectors, a general challenge is that cooperation and knowledge-sharing between universities and the wider innovation ecosystem requires a mindset shift, and a willingness to embrace the different cultures that exist in different sectors.

A university network commented that changes in mindsets are necessary to overcome barriers to the establishment of wide innovation ecosystems. "Innovation ecosystems create an environment where interaction is spontaneous and the mutual sharing of expertise in the spirit of open science is promoted". This facilitates the "creation of something new together from the very beginning of the research, which requires a more open mindset".

Challenge 1: The need to consolidate and strengthen University Business Cooperation (UBC), and to address barriers, especially in the 'widening' countries, where such cooperation is often unstructured.

Many universities have been engaging in UBC and have developed collaborative relationships with industry and business, for example through the role of Technology Transfer Offices (TTOs) and Industrial Liaison Offices (ILOs), which facilitate intersectoral mobility and play a knowledge-brokering role. However, whereas UBC is relatively well-established in many EU countries, including at a strategic level within universities, this is not the case everywhere, as progress varies across the EU Member States. Whereas universities in some countries have more than two decades' experience of UBC, in others, especially widening countries, cooperation is less institutionally embedded, and often extends back for a much shorter period of time.

An EU-level business association taking part in the study stakeholder consultations stated that it would be beneficial if more universities could focus more closely on the transfer of academic know-how into the development of new products, services and other market offerings. However, this would need to be supported through a structured approach. In some universities, for example, there is support for start-up creation, and the institutions encourage academics and researchers to set up spin-offs. In many others, whilst there are such innovation and business support services in the wider ecosystem, they do not exist in the university itself.

In many Central and Eastern European countries, the literature points to a **lack of a culture of public-private sector collaborative partnership-working on research,** or the involvement of universities and industry working together on a sustainable basis.[243] Often, cooperation is *ad hoc,* and linked to EU funding, for instance to research projects funded under the European Structural and Investment Funds (ESIFs). This is demonstrated in the country reports produced through the Horizon 2020 Policy Support Facility (PSP), published in the Research and Innovation Observatory.[244] This covered the

[242] LERU. (2018). *Open Science and its role in universities: A roadmap for cultural change*. https://www.leru.org/files/LERU-AP24-Open-Science-full-paper.pdfz

[243] European Commission. (2018). *Study on Fostering Industrial Talents in Research at European Level* – Available at: https://cdn5.euraxess.org/sites/default/files/policy_library/final_report_intersectoral_mobility.pdf , also see country reports under the "Stairway to excellence (S2E)" project launched in 2014 as a European Parliament pilot project executed by DG-JRC together with DG-REGIO. [Online] [Accessed 15 May 2020] Available at: https://s3platform.jrc.ec.europa.eu/stairway-to-excellence

[244] Country reports for the Research and Innovation Observatory are available here - https://rio.jrc.ec.europa.eu/

full EU-27, but identified particular challenges in widening countries, as per the selected examples of the situation regarding different countries below:

Box 4-1 - Examples of challenges in fostering UBC in different EU countries

Examples of challenges in UBC and country-specific initiatives to overcome these:

- In **Greece,** key barriers to UBC are lack of government funding, and universities' lack of awareness about the opportunities arising from collaborating with businesses. [245]
- In **Hungary,** the 2017 RIO country report [246] mentions that in the Global Innovation Index 2017, Hungary was ranked 109th in university-business collaboration, which improved to 68th place due to the establishment of university-industry collaboration centres (FIEKs) and continued R&D investment by companies.
- In **Italy,** Italian business representatives surveyed [247] saw UBC as being less beneficial for themselves compared with for students and society. A lack of support mechanisms was identified as a further problem. A further inhibitor of cooperation was Differing time horizons between universities and business. Regarding drivers, the availability of funding was seen as the biggest factor driving cooperation.
- In **Lithuania,** in the 2000s and up to 2015, there were structural challenges in fostering closer cooperation between universities, industry and business. Whilst there were some public-private ESIFs R&D&I projects supported involving universities, these did not encourage more sustainable forms of cooperation. More positively, the implementation of the smart specialisation strategy in 2014-2020 has led to measures to support research capability building through collaborative projects, the development of technology transfer centres, and stimulating university spin-offs through the creation of a seed capital fund. [248]
- In the **Czech Republic,** underdeveloped public-private research linkages are a major weakness of national innovation systems (SRI, 2015 and European Commission, 2017). The RIO country report 2017 notes that "despite sustained policy efforts, linkages between public and private R&D sectors could be further improved".[249] Some specific initiatives have been adopted to counteract the problem, e.g. setting up of National Centres of Competence to foster collaboration between enterprises and research organisations in the public sector. GAMA is specifically designed to support the practical application and commercial use of R&D results, whereas ZÉTA supports the mobility of young researchers.
- In **Slovakia,**[250] there are a lack of people with business knowledge in universities. In addition, for Slovak businesses, university bureaucracy is an important barrier. It is more typical for Slovak businesses than elsewhere to lack awareness about university research activities and offerings.

However, there are more positive examples where there are closer linkages between private company R&D&I activities, and public sector R&D&I, including universities:

- In **Croatia,**[251] the contribution of private companies to public sector R&I activities is greater than in many EU countries. Private companies contribute 8.4% of total funds for R&I activities in universities.

[245] https://www.ub-cooperation.eu/index/greecebus
[246] https://rio.jrc.ec.europa.eu/country-analysis/Hungary/country-report
[247] https://www.ub-cooperation.eu/index/italybus
[248] RIO Country Report 2017: Lithuania, Paliokaitė A., Petraitė M., Gonzalez Verdesoto E., 2018 - https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/rio-country-report-2017-lithuania
[249] RIO Country Report 2017: Czech Republic, Shrolec, M., and Sanchez-Martinez M., - https://rio.jrc.ec.europa.eu/country-analysis/Czech-Republic/country-report
[250] Source - http://www.cem-uk.sk/projekty/prieskumy/prieskum-kteme-spolupraca-univerzit-a-biznisu-na-slovensku-perspektiva-podnikatelskych-subjektov/?IDe=41699&IDcheck=7ae6f212fbcc0cda0cf4b77e36d758f8
[251] RIO Country report Croata, 2017, Domagoj Račić; Jadranka Švarc - https://rio.jrc.ec.europa.eu/country-analysis/Croatia/country-report

As the selected examples provided in the above table demonstrate, some countries face challenges in developing sustainable cooperation in R&D&I between the private sector and public sector research actors such as universities. It is worth noting that in widening countries, ESIFs funding has been a positive driver of change in fostering closer cooperation between universities, other publicly-funded research actors and the private sector, as a number of Operational Programmes (OPs) have made such cooperation a priority.

The scope for further synergies between different EU funding sources could be further reinforced in planning for the new MFF in 2021-2027. For instance, a guide was developed by DG REGIO in June 2014 to outline potential synergies between different EU R&I related programmes, namely between European Structural and Investment Funds (ESIFs), Horizon 2020, COSME, Erasmus+, Creative Europe, etc. [252] Consequently, in countries like Estonia or Slovenia, the ESIF have made a significant contribution to strengthening the excellence of the research base.

In a **Smart Specialisation context**, the JRC's Stairway to Excellence project tackled the issue of the absence of sufficient and sustainable public-private sector cooperation in R&D.[253] This initiative is centred on the provision of assistance to the EU Member States and their regions in: (i) developing and exploiting the synergies between ESIFs, Horizon 2020 and other EU funding programmes and (ii) closing the innovation gap, in order to promote excellence in all regions and EU countries as well as (iii) fostering the effective implementation of national and regional Smart Specialisation Strategies. In terms of lessons learned from efforts to tackle innovation gaps in less advanced European countries in R&D&I, the need to "reinforce cluster policies to encourage cooperation between public and private stakeholders" was emphasised.[254]

Whilst some specific barriers to UBC were identified in selected widening countries and beyond, there are common challenges across many Member States in fostering cooperation between universities and industry more systematically. Among the barriers identified in a previous study for DG EAC[255] on the state of play in UBC cooperation were "linked to a lack of funding and resources, which is a barrier to cooperation. However, academics specifically name bureaucracy and the lack of work time as inhibitors, and business identify cultural differences with respect to time management and differing motivations as specific obstacles". Moreover, the same study found that despite progress in fostering UBC, "there remains a lack of awareness of how HEIs and business can cooperate and how these activities (inter)relate".

Overall, fostering closer UBC cooperation needs to be further supported at EU level to enable universities to engage in structuring activities to ensure that cooperation with industry and the private sector more broadly is more institutionally embedded.

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[252] European Commission. (2014). *Enabling synergies between European Structural and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programmes: Guidance for policy-makers and implementing bodies*. Luxembourg: Publications Office of the European Union) Available at: https://ec.europa.eu/regional_policy/sources/docgener/guides/synergy/synergies_en.pdf. The guide was prepared on the basis of extensive work of an inter-service working group co-chaired by DG REGIO and DG RTD.

[253] https://ec.europa.eu/jrc/en/research-topic/stairway-excellence-s2e

[254] https://publications.jrc.ec.europa.eu/repository/bitstream/JRC111888/jrc111888_jrc111888_addressing_the_innovation_gap-lessons_from_the_stairway_to_excellence_(s2e)_project.pdf

[255] The state of university-business cooperation in Europe, Authors: Prof. Dr. Todd Davey, Arno Meerman, Dr. Victoria Galan Muros, Balzhan Orazbayeva and Prof. Dr. Thomas Baaken. Study for the DG Education and Culture, European Commission.
https://www.ub-cooperation.eu/pdf/final_report2017.pdf

Challenge 2: The need to strengthen technology transfer, the effectiveness of IPR management and exploitation systems in universities, and to support university spin-offs.

Many universities have developed technology transfer strategies, and have institutional mechanisms in place to address these. However, within many other universities, there is a need to strengthen technology transfer, and the effectiveness of IPR management and exploitation systems in universities.

The effectiveness of efforts by universities to transfer new technologies and to commercialise R&D results varies across the EU and internationally. Some universities have been successful in fostering technology transfer, and in generating income from R&D through contract research and the licensing of patents and other forms of IPR. Some universities have much better internal support for IPR than others (e.g. those with TLO and ILO structures in place), and commonly employ specialist staff with IPR expertise to develop IPR frameworks to enable cooperation with industry to take place, and to support academic entrepreneurs and university spin-offs.[256]

A 2014 study which looked into university spin-off activity in Italy, Norway and the UK notes that the "creation of spin-off firms from universities are seen as an important mechanism for the commercialization of research, and hence the overall contribution from universities to technology development and economic growth". [257] The important role played by TTOs is also highlighted in the report. An interesting finding from the study was that "changes in the institutional framework, such as the changes in the IPR legislation at national level and the establishment of a TTO at university level, *h*ave a positive effect on the number of spin-off created, while the average performance of these ventures decreases".[258]

The EUA notes in a 2005 initiative that Europe's universities are increasingly developing partnerships in their research and innovation missions, embracing the "Open Innovation model" of university-business collaboration and seeking to embed this is in sound project management and improved intellectual property (IP) management that reflects respective interests".[259] In 2008, a Commission Recommendation[260] was adopted on the management of intellectual property in knowledge transfer activities and a Code of Practice for universities and other public research organizations

There is a lack of adequate support to help universities to maximise the potential of research outcomes generated. There is also arguably the absence of recent good practice materials on how to support the improved organisation and management of collaborative research and knowledge exchange and the management and exploitation of IPR. For instance, the EUA produced guidance through its Responsible Partnering Initiative to foster University-Business Collaborative Research by developing a handbook based on good practices in university/industry collaborative research in 2005. This was updated in 2009 and incorporated a Recommendation on the management of IP in knowledge transfer activities and a Code of Practice for universities. It addresses the differing contexts in

[256] Mustar, Philippe & Clarysse, Bart. (2008). University spin-off firms: Lessons from ten years of experience in Europe. Science & Public Policy - SCI PUBLIC POLICY. 35. 67-80. 10.3152/030234208X282862.
[257] Institutional determinants of university spin-off quantity and quality: longitudinal, multilevel evidence from Italy, Norway and the UK. http://www.oecd.org/sti/inno/6_3_Wright_et_al.pdf
[258] Idem. Pg. 3
[259] https://eua.eu/101-projects/593-responsible-partnering-initiative-and-university-business-collaborative-research.html
[260] Commission Recommendation on the management of intellectual property in knowledge transfer activities and a Code of Practice for universities and other public research organizations C(1329)2008

which these activities take place. However, this initiative and EU-level policy developments in this area are already more than a decade old.[261]

In the US, more recent good practices regarding IPR issues in university-industry collaboration are available. For instance, the University-Industry Demonstration Partnership (UIDP)[262] in the US has developed different options regarding IPR approaches and rights-sharing for universities and industry to enable them to cooperate together. In addition, they have developed a guidance manual to facilitate university-industry research contracts. This covers contractual relations between the two parties, and differentiates between background and foreground IP.

In the 1990s, in many European countries and in some other countries globally (e.g. Japan), reforms were instituted by public research funders to allow universities to register patents and to generate licensing income from research outputs and outcomes produced during the project. This represented a major reform as in many countries, either the institution or the academic were given ownership title of the IP.

National legislation on the assignation of IPR rights in universities varies widely across Europe. For example, in countries such as **Austria, Denmark, Germany** and **Japan**, "the right to ownership has now been transferred to the universities while academic inventors are given a share of royalty revenue in exchange".[263] Conversely, in Ireland, the university holds exclusive ownership of the IPR.

A statement by ALLEA[264] by from November 2019 notes that "some countries lack the financial resources and infrastructure necessary to implement IP strategies at universities, or they are only available to major universities. In this case, the major universities should offer IP assistance to all other universities in the country through their Technology Transfer Office (TTO) network and, in return, share the profits of the patents created through the TTO network with the major universities. As **Italy** does not have a TTO network, this was likely the reason why the Italian legislator, contrary to the international trend, has recently changed the law, so that university professors and assistants, rather than universities, own their inventions". In **Austria**, through the University Organisation Act, a comparable legal provision was repealed, as the initiative was not considered to be an economic success and additional problems had arisen.

Agreeing IPR arrangements can present a barrier for universities in cooperating with other sectors, especially with industry and business. This may, for instance, lead to delays in joint research projects, and contract research projects getting underway. In many EU Member States, there is also a lack of institutional support at the level of the university to deal with IPR matters, due to the specialist nature of skills required, the fact that not all universities have TTOs in-house, etc.

There are also **challenges for universities in getting the incentives structures right.** "Encouraging innovation to commercialize research results by granting them title to IP can be useful but it is not sufficient to get researchers to become inventors. The key is that

[261] https://eua.eu/resources/publications/409:responsible-partnering-joining-forces-in-a-world-of-open-innovation.html and "Responsible Partnering: Joining Forces in a World of Open Innovation" in 2005, https://eua.eu/resources/publications/409:responsible-partnering-joining-forces-in-a-world-of-open-innovation.html.
[262] Contract Accords for University Sponsored Agreements, the UIDP, 2012. All rights reserved. https://www.uidp.org/publication/contract-accords/?download=422
[263] Academic Patenting: How universities and public research organizations are using their intellectual property to boost research and spur innovative start-ups, Mario Cervantes, Economist, Science and Technology Policy Division, Directorate for Science, Technology and Industry, OECD https://www.wipo.int/sme/en/documents/academic_patenting.html
[264] ALLEA statement, November 2019, The Need for Intellectual Property Rights Strategies at Academic Institutions.

institutions and individual researchers have incentives to disclose, protect and exploit their inventions". Getting IPR sharing arrangements right may therefore require specialist advice, support and guidance, either from a TTO, an external consultant, or from specialist IPR support services funded by the EU and/ or at national level, such as the European IPR helpdesk (although this is mainly focused on supporting businesses).

Participation in the EU RTD Framework Programmes (FPs) by universities has generated new IP, although in previous studies, the focus has been on the number of different forms of IP generated, and less on measuring the value of their commercialisation. A 2015 study for the Commission on the impacts of participation in the FPs[265] found regarding the IP generated that "572 projects involving universities were found to have at least one form of IPR generated, mainly patents, but also utility models, a registered design and trademarks. However, compared with the totality of projects, "these numbers suggest that only about 2.6% of the analysed UNIV projects report at least one patent application".

Further **guidance at EU level is arguably needed on IPR in a university context, including guidance for universities themselves, for academics and researchers**. If such guidance were to be developed, it must however recognise that there are national-specific differences in academic IPR rules e.g. whether the rights are owned by the university, the academic/researcher, or a combination of the two. Any guidance would therefore have to be tailored nationally and consider disciplinary differences. For example, IPR practices in pharmaceuticals are very different from those in ICT and humanities.

The **role of open innovation and knowledge dissemination** in stimulating the uptake of research outcomes should also be stressed. Indeed, it is important to **strike a balance between protecting IPR (where appropriate) and open innovation practices.** Whereas some knowledge generated may constitute IPR worth protecting for universities, equally, there can be advantages in disseminating knowledge openly, such as promoting knowledge spill-overs, ensuring broader societal take-up of research outcomes, and delivering value back to local communities. Managing the tension between the two can however pose challenges for universities.[266] The way in which IPR issues can be managed in an open science context is dealt with in TM6.

Challenge 3: Ongoing importance of strengthening partnerships with other sectors and the lack of adequate institutionalisation of cooperation structures.

Strengthening partnerships between universities, government ministries, public service providers and third-sector organisations could generate positive societal outcomes by harnessing knowledge generated through collaborative research activities. Cooperation between academia and government - whether at national or EU level - has the potential to be highly beneficial.

Participation in the EU RTD Framework Programmes (FPs) by universities has been an important driver of transnational collaborative research activities, as confirmed in various programme evaluations, and in impact studies that examined the impact of university participation in the EU RTD Framework Programmes.[267]

[265] European Commission, DG RTD, An analysis of the role and engagement of universities with regard to participation in the Framework Programmes - https://op.europa.eu/en/publication-detail/-/publication/640a37db-0b71-11e6-b713-01aa75ed71a1

[266] Al-Sharieh, S. and Mention, A. (2013). Open innovation and intellectual property: the relationship and its challenges. The Dark Side of Technological Innovation. Charlotte: Information Age Publishing.

[267] European Commission, DG RTD, An analysis of the role and engagement of universities with regard to participation in the Framework Programmes - https://op.europa.eu/en/publication-detail/-/publication/640a37db-0b71-11e6-b713-01aa75ed71a1

However, outside of the RTD Framework Programme, direct collaboration between universities, government ministries and other public sector institutions is not that common, for instance, regarding joint research projects.

Co-operation takes many forms and requires appropriate organisational and management structures to be put in place. Where there is a lack of such structures and dedicated staffing support within universities to foster cooperation with sectors beyond industry and business, this puts pressure on academics and post-doctoral researchers to build such relationships themselves without adequate support. This means that there is also a risk that strategic relationships are not forged and that relationships with other sectors are dependent on individuals rather than systematised institutionally.

Presently, cooperation is often carried out on an ad-hoc basis when, for example, government committees seek expert consultations. It has been argued, however, that academics, and the universities they belong to, have the potential to contribute positively to policymaking in different policy fields if they are involved more systematically and consistently.[268]

Whilst in some EU countries, intermediary structures are well-developed for UBC, e.g., through the role of TTOs and ILOs, there is often a lack of equivalent structures to strengthen, systematise and institutionalise cooperation between academia and other sectors, such as in government and the third sector. A consequence is an over-reliance on joint research projects, such as those funded through the FPs. In some cases, feedback received during the workshop suggested that there was sometimes an over-dependency by universities regarding sustaining relationships outside the business sector on bilateral relationships between individual academics and their contacts in the public sector and third sectors. The lack of a strategic approach to knowledge brokering is a gap where pilot interventions might be supported to foster experimentation and the exchange of experiences.

Knowledge brokers (see success story example below) will play a role in creating bridges with sectors beyond business and industry, but presently, few universities employ specialist knowledge brokers. Moreover, their long-term effectiveness is often constrained by their status being not well-recognised or understood, insecure contracts and a lack of formal career pathways. Whilst knowledge brokers could potentially play a crucial intermediary role between academia and other sectors, their positions are currently under-resourced within, and beyond the university system.[269]

Challenge 4: The importance of the intersectoral mobility of researchers, and the need to overcome obstacles to such mobility.

As noted in TM on strengthening human capital, the intersectoral (and international where appropriate) mobility of researchers is recognised as having a number of benefits both for the individual researcher and strategically for universities, as well as for other sectors themselves (e.g. companies seeking industrial or other talents, at the industry/ sectoral level, among government and the third sector).

However, there remain low levels of awareness about intersectoral mobility, compared with international mobility. Moreover, the level of bidirectional intersectoral mobility among university researchers and other sectors could be increased to foster greater

[268] Williams, A. (2010). Is evidence-based policy making really possible? Reflections for policymakers and academics on making use of research in the work of policy. *Working for policy*, 195-210.
[269] InterAction (2016). How can academics and the third sector work together to influence policy and practice? Dunfermline: Carnegie UK Trust. Available at: https://d1ssu070pg2v9i.cloudfront.net/pex/carnegie_uk_trust/2016/04/LOW-RES-2578-Carnegie-Interaction.pdf

cooperation between sectors. This applies both on a disciplinary and inter-disciplinary basis.

There remain obstacles to the mobility of researchers between sectors, and some of these were detailed in the section on human capital, such as the inflexibility of national career systems for researchers and academics to secure recognition for periods of mobility to other sectors.

In addition, there are significant variations of cross-sectoral mobility, especially across academic disciplines and regarding the directions of existing mobility. In their study on PhD student mobility, Klofsten et al (2012)[270] found that doctoral students at engineering faculties undertook mobility placements in the private sectors to a much higher degree compared to their counterparts at other faculties. Moreover, certain disciplines were discovered to be more conducive to research mobility. Indeed, health sciences, arts and SSH candidates took part more frequently in mobility engagements at other universities as well as in organisations in the public sector. Consequently, it is important for universities to keep these patterns in mind when developing effective third mission tactics and strategy.

This represents a missed opportunity as the public sector and third sector could benefit from applying the rigour of scientific methods to practical problems, such as how to improve and strengthen the efficiency of public service delivery.

Challenge 5: The need to systematise and institutionalise universities' role in contributing to social innovation through closer engagement and collaborative research with other sectors.

Social innovation has an especially important role to play in contributing to addressing the societal challenges. Universities generally, particularly through research excellence in the Social Sciences and Humanities (SSH), are strategically well-equipped to contribute to SI. Indeed, closer intersectoral cooperation involving universities also holds strong promise in the context of the quintuple helix model to catalyse social innovation related to "new products, services, and models aiming to improve human well-being and create social relationships and collaborations".[271] Social innovation has an especially important role to play in contributing to addressing the societal challenges (see cross-cutting TM 3.1).

Among the main challenges/barriers to strengthening universities' contribution to the successful development of social innovation identified are**:**

- Lack or gaps of knowledge, leading to limited transfer and diffusion. The traditional model based on a purely commercial process aimed at storing than sharing the knowledge coming from universities, then licensing or creating spin-off companies.
- Gaps when it comes to cooperation and communication between academia and other sectors, despite the fact that they could perfectly complement each other in supporting social innovations with their different strengths.
- While many universities recognise their role in supporting societal change and the influence they could have by actively promoting social innovation, most universities

[270] Bienkowska, D., & Klofsten, M. (2012). Creating entrepreneurial networks: academic entrepreneurship, mobility and collaboration during PhD education. *Higher Education*, 64(2), 207-222.
[271] Carayannis, E.G., Grigoroudis, E., Stamati, D. and Valvi, T. (2019). Social business model innovation: A quadruple/quintuple helix-based social innovation ecosystem. *IEEE Transactions on Engineering Management*. Pp 1.
[271] Social Innovation through Knowledge Exchange (SIKE). (2019). What can universities do to support social innovation? [Online] [Accessed 15 May 2020] Available at: https://sike-eu.org/2019/05/24/what-can-universities-do-to-support-social-innovation/

are still not taking a sufficiently strategic approach.[272]

- Local and regional ecosystems tend to favour more commercial and technological forms of innovation, than the social ones.

In order for the role of universities in social innovation to change so that it is dealt with in a more systematised manner across the board, SI-related aspects might have to be integrated in the performance evaluation of institutions.

Challenge 6: The need for a participative culture to fostering broader knowledge and innovation ecosystems and co-creation.

Current innovation activities run by universities are often focused on the commercialisation of research outcomes and on technological innovation, and less on interaction with different stakeholders that could benefit from the high innovation potential of universities (which remains mostly untapped).

Closer collaboration between all actors in the ecosystem stimulates social innovation and has other advantages such as increasing the societal relevance of research. In a co-creation, participative model, it is important to adopt an interdisciplinary approach and not to over-focus on applied sciences as the involvement of other disciplines could have the potential to contribute to the growth of wider innovation ecosystems. Innovation ecosystems create an environment where interaction is spontaneous and promote the sharing of expertise in the spirit of open science and open innovation. It facilitates the co-creation of new ideas and solutions from the very beginning of the research by bringing in complementary knowledge and resources from a wide range of players and disciplines. However, as some stakeholders involved in the study have pointed out, such developments will require a more open mindset on cooperation and sharing from many universities.

Although important research occurs within universities and is published by various academic and non-academic publishers, that is not universities' sole purpose in society. Indeed, 'both researchers and different societal stakeholders relate far better to this dynamic model of knowledge production than to the linear model. It matches their practice and thus their "reality" in the sense that it also takes into account factors such as time, unpredictability, chance and unforeseen consequences.'[273] The future of societal engagement will emphasise the co-production of knowledge, and reflect the dynamic, non-linear nature of research.[274]

Fostering closer interaction between universities and stakeholders in other sectors will ideally need to work in a symbiotic manner, in line with the concept of a co-creation model. Effective practices in this regard include the innovative translational research centres which some universities have set up, in collaboration/co-location with industry, such as an example from Switzerland.[275] This concept is about creating new spaces and structures for co-location and the co-development of ideas, and their investigation through shared infrastructures.

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[272] Social Innovation through Knowledge Exchange (SIKE). 2019. What can universities do to support social innovation? Available at: https://sike-eu.org/2019/05/24/what-can-universities-do-to-support-social-innovation/

[273] LERU. (2017). *Productive Interactions: societal impact of academic research in the knowledge society.* https://www.leru.org/files/Productive-Interactions-Societal-Impact-of-Academic-Research-in-the-Knowledge-Society-Full-paper.pdf

[274] LERU. (2017). *Productive Interactions: societal impact of academic research in the knowledge society*. https://www.leru.org/files/Productive-Interactions-Societal-Impact-of-Academic-Research-in-the-Knowledge-Society-Full-paper.pdf

[275] Sitem-insel is an independent, non-profit public private partnership. Government funding has been approved for the start-up phase. Subsequently sitem-insel will be financially independent. See https://sitem-insel.ch/en/

Co-creation could bring synergies with other experts with knowledge from across different types of research-focused organisations, research institutes and industry. Universities do not just create knowledge; they also coordinate actors in innovation networks and knowledge clusters, which in turn can help to foster the co-creation process. They actively participate in thematic networks and can play a core role in facilitating and moderating such intersectoral exchanges with a view to identifying potential areas for research activities and co-creation between sectors.

The concept of co-creation could be extended to research activities being led by academics and post-doctoral researchers within universities. There is evidence that students also wish to participate in the co-creation process.[276] Currently, not all universities in Europe allow students and researchers to take part in interactions with other sectors, and there are evidently different ways of engaging them in interactions with other sectors, such as intersectoral mobility periods, collaborating on joint research projects, etc.

Currently, neither universities nor their representative bodies have direct access to the Policy Support Facility (PSF).[277] To date, the PSF has been predominantly used by EU13 Member States (apart from Mutual Learning aspect) but is open to all. Universities are already included as stakeholders in some activities but have no formal role in the PSFD structures and are only able to attend in an invited role.

Challenge 7: Creating supportive policy frameworks to be able to pursue inter-sectoral cooperation.

The single most successful driver of universities' role in innovation ecosystems is the extent of their ability to take risks. This varies depending on the prevailing national policy and legal framework, the degree of autonomy that universities have in setting their own research agendas independently from national government, funding arrangements and the extent to which the EU policy framework is supportive, etc.

Therefore, stability in funding, autonomy, and room to make strategic long-term decisions without being encroached by other actors is fundamental. EU and national policy frameworks to address these items will favour better synergies and thus the growth of innovation ecosystems.

Challenge 8: Ethical concerns regarding cooperation with other sectors.

This challenge is also related to the cross-cutting theme of trust. The perceived independence of universities brings them credibility and fosters societal trust in their way of operating and in carrying out research. Closer interaction with other sectors in the context of wider innovation ecosystems means that universities need to maintain some degree of transparency in terms of how they monitor potential risks, including ethical considerations and conflicts of interest related issues ex-ante, during research activities and through constant monitoring and ex-post assessment. However, it would not be possible to remain totally transparent in working with industry, given intellectual property considerations, and confidential relationships with companies (sometimes legally enforced by non-disclosure agreements).

An example in this regard is the need for universities to ensure that research activities (and the associated outcomes and impacts) monitor dual-use issues from the outset. Dual use issues are increasingly important in the context of research and innovation generally,

[276] Dollinger, M., Lodge, J. and Coates, H. (2018). Co-creation in higher education: Towards a conceptual model. *Journal of Marketing for Higher Education*, 28(2), 210-231.
[277] The PSF follows a service-oriented approach, and provides a broad range of services to address the needs of policy makers in Europe in terms of formulation and implementation of research and innovation policies, including studies to consider reform of national R&I systems and structures.

and various literature and guidance has been produced on these topics both at EU level [278]and in different scientific disciplines.[279] However, dual-use is a complex issue. Whilst in some instances, the aim is to avoid potential dual-use and to monitor the associated risks, in other cases, national level and EU public R&I funding may actively support the development of dual-use technologies to promote disruptive innovation.

Universities also necessarily consider dual use issues in an FP context, as they are major research actors, accounting for 40% of total participations. While Horizon 2020 projects focus exclusively on civil applications, there are opportunities for dual-use innovations. Equally, there is a need to monitor the potential risk of adverse impacts due to dual-use. This may be more relevant in some research disciplines and specific programmes within the FPs compared with others.[280]

Challenge 9: Bridging cultural differences between universities and the voluntary sector as regards research activities.

NGOs could benefit from a closer relationship with researcher in universities. Different types of NGOs may have interests in different types of research. For example, many NGOs are interested in blue sky research to advance knowledge of certain phenomena, e.g. cancer research, research into coronaviruses. However, other NGOs and Civil Society Organisations (CSOs) in the voluntary sector instead seek research results that are user-oriented.

A further issue is that whilst some universities have a close relationship with NGOs and CSOs as part of their research mission, others do not. There is also evidence of less structured cooperation within universities to facilitate cooperation with these sectors, as there is often no equivalent to the Technology Transfer Office / ILO that facilitates cooperation with industry. Some universities do not have a strong relationship with NGOs, which can be a missed opportunity, for instance in terms of intersectoral researcher mobility opportunities. In such universities, this could require a change in their cultural mind-set to enhance cooperation.

Within academia, engagement with other sectors could be recognised in career assessment (also see TM1 on human resource capacity). It can also be promoted by strengthening the structuring of cooperation between universities and other sectors (including through its institutionalisation) and through intersectoral researcher mobility.

Challenge 10: Maximising societal impacts and strengthening public engagement and citizen science

This challenge covers a range of inter-related issues, notably the need identified in EU-level evaluations of the RTD FPs to maximise societal impacts of EU-funded R&I projects through further efforts to promote citizen science. At the level of individual institutions, arguably, there are growing pressures on universities e.g. from citizens, funders, national authorities to maximise societal impacts, although clearly universities already do a good job in this regard. This could involve, for instance, incentivising and motivating researchers to engage with the public, and encouraging universities to strengthen their commitment

[278] European Commission. (2014). *EU funding for Dual Use - guide for regions and SMEs*. Brussels: DG ENTR. Major contribution from Christian Saublens, Director of the European Association of Development Agencies (EURADA).
[279] Bowman, K. and Husbands, J.L. O. (2011). Dual Use Issues in the Life Sciences: Challenges and Opportunities for Education in an Emerging Area of Scientific Responsibility. *CBE—Life Sciences Education*, 10(1),3-7.
[280] For instance, dual use is a particular issue in programmes such as the Secure Societies programme in Horizon 2020. See CSES. and RPA. (2017). Brussels: European Commission. *Interim Evaluation of Secure Societies programme in Horizon 2020.* Available at: https://op.europa.eu/en/publication-detail/-/publication/b8d4d47e-9db0-11e7-b92d-01aa75ed71a1

to citizen science, where appropriate and only when this does not compromise the overriding focus on research excellence.

This challenge considers the inter-related issues of citizen science and public engagement by universities, the latter being a broader issue than the former. LERU has produced guidance and recommendations on citizen science in which it notes the strong potential of citizen science to contribute towards improving research, and its important role in Open Science (see TM6). Whilst not all universities may wish to engage in citizen science type activities, there can be considerable advantages. The LERU guide points to *"enabling citizens to engage in monitoring pollution, collecting data on biodiversity, language studies as well as many other research activities".*[281] Given this largely untapped potential, citizen science could be used by a broader range of universities than is presently the case. Furthermore, metrics to monitor progress could be strengthened, notwithstanding the concerns among university networks that these should remain voluntary means of assessing one facet of universities' performance rather than mandatory.

The LERU report also points out that the citizen science projects have been increasing due to the "widening interest of citizens in science, the growing availability of advanced communication technologies, and increasing concerns about various issues of general interest such as environmental sustainability and cultural heritage conservation. Governments are increasingly interested in strengthening citizen involvement in science projects for education. In addition to these trends, the European Commission is advocating strongly for an open science agenda, of which citizen science is an important element".

Yet there are also challenges for universities in embracing citizen science. Some studies observed that data collected by citizen scientists may not be reliable. [282] A further challenge is that engaging with the public is time-consuming, and may be perceived as a superfluous extracurricular activity rather than integral to one's work. It must be made clear to researchers, at a departmental institutional, regional and national level, how this will aid both their research and the creation of "socially robust knowledge", in which science is no longer confined to the production of evidence-based results, but rather an active presence in society. It is no longer about obtaining knowledge for the sake of it, but about what we can do with it, how much we really understand, and how we implement it.[283] Advocacy for such ideals must be paired with pragmatic considerations, such as researcher reputation, remuneration, and capacity.

A further issue is the increasing importance of the societal impact of research projects, and the implications this might have for strengthening citizen science.

In Horizon 2020, there was already a trend towards greater involvement of stakeholders and discussions regarding has increased. However, "the interim evaluation of Horizon 2020 identified one of the main areas for improvement as being the need to bring results to citizens by involving them more. Consequently, Horizon Europe will demand even further citizen involvement".[284] A study for the Commission's DG RTD also notes that "there is a need for greater outreach to civil society to better explain results and impacts and the contribution that research and innovation can make to tackling societal challenges, and to

[281] Citizen science at universities: Trends, guidelines and recommendations, LERU, the association of research-intensive universities.
[282] Mitchell, Nicola & Triska, Maggie & Liberatore, Andrea & Ashcroft, Linden & Weatherill, Richard & Longnecker, Nancy. (2017). Benefits and challenges of incorporating citizen science into university education. PLOS ONE. 12. e0186285. 10.1371/journal.pone.0186285.
[283] LERU. (2017). *Productive Interactions: societal impact of academic research in the knowledge society*. https://www.leru.org/files/Productive-Interactions-Societal-Impact-of-Academic-Research-in-the-Knowledge-Society-Full-paper.pdf
[284] Impact of Social Sciences and Humanities for a European Research Agenda – Valuation of SSH In Mission-Oriented Research, Rethinking Societal Impact – Collaboration With Stakeholders (2019). Bettina Uhrig. https://repository.fteval.at/447/1/Journal48_10.22163_fteval.2019.378.pdf

involve them better in the programme co-design (agenda-setting) and its implementation (co-creation)." Moreover, the report from the "High Level Group on maximising the impact of EU Research & Innovation Programmes" has called for mobilising and involving EU citizens through the co-design and co-creation of programmes and projects at European, national and regional levels.[285] This led to a Commission Communication in 2018, which refers to the need to "create more impact through mission-orientation and citizen involvement".[286] Public engagement manifests in different ways, depending on a researcher's discipline. Public engagement in scientific topics could involve study recruitment and bringing in young people to learn about the types of equipment used in labs or to observe sample experiments; for humanities subjects, such as English and philosophy, universities could coordinate secondary school visits, author talks, open debates and writing/essay competitions; for social sciences, on top of the activities already mentioned, public engagement could centre around deliberating research questions with sample populations or open access libraries. These are but a few methods, and researchers must collaborate both within, and across disciplines to devise ways that their institutions can best engage with their respective local populations.

Two examples of citizen engagement in science are now presented. The first is from the **University of Maastricht.** The Maastricht Platform for Community Engaged Research (MPCER), which is a multidisciplinary platform that support research that solves societal challenge, involves the local community in the research and shares the results with citizens. Wider possibilities for Citizen Science were also identified, such as the **University of Antwerp**, where citizens have participated in collecting samples/data on outdoor air quality. Such topics are of interest to all citizens, and therefore easily implemented. The research focus of member universities will affect the focus, but could be then spread among them, gaining information in different countries. Other institutions are already embedding within their strategies and structures a holistic approach to citizens' science in which their needs and perceptions also influence the institutional research agenda (see below an example from University of Southern Denmark).

As stakeholders have pointed out, making progress in this area is easier said than done. In order to implement a public engagement curriculum, or establish any open events to engage citizens in research processes taking place at universities and in their localities, academic staff must have the time to both lead these efforts and maintain their pedagogical and/or research commitments, and at a consistent standard too. In addition, there should be skills development and training for researchers to teach them how to reach out to the public. Support is also presently often lacking for academic staff members who agree to incorporate public engagement into their curricula or research. Such training would provide them with important skills, such as proactivity, strong communication, transparency, and a robust foundation of research ethics.[287] Above all else, any change implemented in universities should support and improve the quality of teaching and research. If more staff are required, or perhaps a specialised public engagement/citizen science expert, that will become an important expense for universities. In cases where a specialist or expert cannot be employed, training staff in public engagement skills is an additional cost to consider.

It is also worth considering what type of EU funding support to strengthen science in society has been made to date in the research sphere, as universities have participated in

[285] Maximising the impact of EU Research & Innovation programmes: Investing in the European future we want. LAB-FAB-APP report of the independent High Level Group on maximising the impact of EU Research & Innovation Programmes.
[286] Horizon 2020 interim evaluation: maximising the impact of EU research and innovation COM(2018) 2 final, Pg 6
[287] Wellcome Trust. *Public Engagement Support for Researchers*. https://wellcome.ac.uk/what-we-do/our-work/public-engagement-support-researchers

projects funded under these budget lines, and have developed excellent practices that could be replicated more widely. Science in society means bringing about social change through engagement and outreach,[288] and has been accorded an important EU political and funding priority for over a decade.

In FP7, through the **Science in Society (SiS) Programme**, which was part of FP7 Capacities and had a budget of €312 million allocated for the period 2007-2013. In Horizon 2020, a further sub-programme was set up, the **Science with, and for Society (SwafS) Programme.** This has a total budget of €462 million and aims to build effective cooperation between science and society, to recruit new talent for science, and to link scientific excellence with social awareness and responsibility.[289]

The Interim Evaluation of Horizon 2020[290] identified a need to strengthen citizen and societal engagement, to help maximise societal impacts. The future Horizon Europe could therefore consider different ways in which citizen and societal engagement could be supported. One possibility would be to **promote the use of Societal Readiness Levels (SRLs)** as a means of drawing attention to the need to involve citizens and societal stakeholders such as NGOs and CSOs in projects, and to consider other ways of maximising societal impacts. A July 2019 research paper about how to strengthen the societal impact of the FPs notes that public debate is needed about the proposed indicators for Horizon Europe. The paper suggests that the focus on "Technology Readiness Levels" (TRLs) of projects needs to be broadened. "For measuring societal impact, a longer timeframe after the end of a project is needed, and, instead of TRLs, programme evaluators and developers could consider the SRLs of a proposal and project. Cooperation with stakeholders could be one indicator for societal impact and be included in the description of the SRLs".[291]

4.6.3 Transformation needs

Considering transformation needs, Carayannis & Campbell's definition of knowledge production systems has been adopted as a "multi-layered, multimodal, multi-nodal, and multilateral system, encompassing mutually complementary and reinforcing innovation networks and knowledge clusters consisting of human and intellectual capital, shaped by social capital and underpinned by financial capital*".*[292] This reinforces the concept of universities as being central to innovation ecosystems and to driving knowledge transfer.

Universities in Europe also need to transform themselves in a way that **bridges the cultural gaps that characterise current differences between sectors**, as this could help to further catalyse intersectoral cooperation. Intersectoral mobility, for example, is a very effective means of bridging such gaps, as it provides a bi-directional mechanism for fostering closer cooperation, and translating this into strategic relationships over time. Universities need to ensure that they develop the necessary relationships with different sectors to enable their doctoral and post-doctoral researchers to work in different sectors, and crucially, ensuring that any period spent in another sector is recognised as part of career progression structures.

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[288] LERU. (2017). *Productive Interactions: societal impact of academic research in the knowledge society*. https://www.leru.org/files/Productive-Interactions-Societal-Impact-of-Academic-Research-in-the-Knowledge-Society-Full-paper.pdf

[289] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/science-and-society

[290] Interim Evaluation of Horizon 2020 (2017) https://ec.europa.eu/info/publications/interim-evaluation-horizon-2020-book_en

[291] Innovation Fund Denmark. (2020). *Societal Readiness Levels defined according to Innovation Fund Denmark*. According to the Danish Innovation Fund, a SRL is a way of assessing the level of societal adaptation of, for instance, a particular social project, a technology, a product, a process, an intervention, or an innovation (whether social or technical) to be integrated into society.

[292] Carayannis E.G., Campbell D.F.J. (2012) Mode 3 Knowledge Production in Quadruple Helix Innovation Systems. In: Mode 3 Knowledge Production in Quadruple Helix Innovation Systems. SpringerBriefs in Business, vol 7. Springer: New York, NY. Pp. 3.

There is also a need for universities to strengthen **governance aspects vis-à-vis managing their relationships with other sectors** to ensure transparency and that ethical norms are respected. For example, whilst close cooperation with business and industry should be ensured, it is necessary to develop good practice guidance and practical approaches to ensuring that universities maintain their independence, and take ethical considerations into account before making final decisions on collaborative research projects.

Regarding **cooperation between academia and the third sector**, both sectors need to find a compromise between the different demands and incentives of working under pressing timetables to address urgent research needs, including *in-situ* research dimensions. More generally, compared with UBC, cooperation with the third sector tends to be less developed. Therefore, strengthening such cooperation represents an opportunity to enable universities to better contribute to the societal challenges, including the SDGs.

Turning to **social innovation,** many universities at global and European level are at the forefront to make it an integral part of their missions. Social Innovation Exchange (SIX), a think tank and global network of social innovators, has identified five dimensions along which universities embrace social innovation. In their paper, they name some European universities (most of them business schools) and a few Erasmus+ programmes deeply involved in such transformation[293]. Similarly, the EUA showcases nine entrepreneurial universities across Europe in its report on "*The role of Universities in regional innovation ecosystems"*, to show "how universities have been instrumental in regenerating their regions in the aftermath of the financial crisis, moving beyond transferring technologies and towards the co-creation of knowledge […]". [294] As innovation strategies broaden their focus to areas of environmental and social innovation and sustainability, the EUA study shows how universities and their partners in regional innovation systems can join forces to build such bridges across institutional and disciplinary boundaries, to look for new collaborative formats and spaces in order to address shared challenges, and to shape their own changing roles in the process.

To illustrate the transformations made by some of these universities, a few examples are hereby provided: "[…] in Munich, the Technical University of Munich (TUM) had integrated social science and humanities modules into their engineering curricula, in addition to promoting digital and entrepreneurial skills across all disciplines. […]. The University of Manchester attributes great importance to social innovation in its social responsibility programme, which is supported by a Social Responsibility Service, headed by a Director who reports to the Associate Vice-president of Social Responsibility". There are various ways in which universities could transform themselves so that social innovation forms a more integral part of the quintuple innovation helix (university-industry-government-public-environment interactions within a knowledge economy).

This would better enable universities to support research-oriented missions such as global health challenges (such as responding to pandemics and epidemics), climate change (especially as regards the consequences related to the needs for societal transformation), and water-related issues (drinkable water, public safety issues), smart cities (with engaged citizens), food and ground related issues. The Universities described in the EUA study represent just a few examples of universities supporting social innovation organisations and cross-sectoral collaborations. According to the study results, it is evident that financial incentives to reward research and teaching engagement for social innovation will enable universities to develop new knowledge paradigms and tools for targeted exchange between actors from all societal sectors. Universities could also create a better understanding of the new processes, skills and tools that are required to exploit the knowledge coming out of universities more effectively and to drive the social innovation

[293] Full report available at this page; last accessed in 4 June 2020.
[294] EUA Study "The role of Universities in regional innovation ecosystems", Dr Sybil Reichert (2019). Available at this page; last accessed 4 June 2020.

agenda. To this end, they will have to reward engagement for social innovation symbolically and in career advancement.

As part of the 2030 Vision, Europe's universities will be highly engaged with society in a multitude of ways. From research design and shaping academics' research questions to directly reflect the needs of their sample populations, to actually working with interested citizens and generating further interest, this area has vast potential for real growth and widespread benefits. Some universities, institutions and Member States have been working on this already, to varying extents, and their work can serve as a model for others.

Public engagement at universities in Europe could therefore employ these factors:

- Trust (in science, knowledge production process, scientists and other experts, and universities as talent deliverers);
- Embedding citizens in the research process;
- Involvement of citizen actors, non-professional scientists, amateur researchers and young academics alongside established researchers;
- Focus not only on the theoretical aspects of one's research, but also how the research can be applied in co-production with society;
- Adherence to established norms, such as the European Citizen Science Association's "Ten Principles of Citizen Science";[295]
- Improved communication and conveyance of research results by all scientists, including a focus on science education activities in local schools and community spaces (supermarkets, town halls, libraries, science museums, etc.);
- Increasing focus on responding to societal needs and demands.

Throughout this process, stakeholders have suggested that universities should liaise with the media to ensure that they are being properly represented, and that the events or programmes are accurately advertised. Their communication strategy should ideally be in line with their strategic research agenda. In addition, there must be adequate funding in place to ensure these strategies can be put in practice at all.

4.6.4 Case studies and success stories

The first example as to how cooperation can be strengthened between universities and other sectors focuses on the Norwegian Public sector Ph.D. scheme (OFFPHD), which highlights how highly-qualified top talents from universities can contribute new ideas to solving challenges experienced by the public sector, such as strengthening the efficiency and effectiveness of public service delivery, including through digitalisation and e-government service delivery. New ways of interacting with citizens have also been researched.

Norwegian Public sector Ph.D. scheme (OFFPHD)[296]
Purpose of case study: Illustrate schemes designed to encourage cross-sectoral mobility between academia and the public sector.

[295] European Citizen Science Association. (2015). Ten Principles of Citizen Science. https://ecsa.citizen-science.net/sites/default/files/ecsa_ten_principles_of_citizen_science.pdf

[296] The Research Council of Norway. (2019) Public Sector Ph.D. Project – Doctoral Project in the Public Sector. [Online] [Accessed 15 May 2020]. Information provided on Research Council Norway's homepage: https://www.forskningsradet.no/en/call-for-proposals/2019/public-sector-ph.d.-project--doctoral-project-in-the-public-sector/.

Norwegian Public sector Ph.D. scheme (OFFPHD)[296]

Objectives: The Public Sector PhD Scheme is intended to expand research activities in public sector bodies, to increase researcher recruitment within the public sector and to promote greater collaboration between academia and the public sector.

Description: The Public sector PhD-scheme allow institutions in the public sector to apply for funding from the Norwegian Research Council for an employee seeking to pursue a doctoral degree. Funded projects are also expected to develop and improve the public sector's capacity to strengthen innovation capacity and to create new and improved solutions. In addition, the doctoral research projects seek to develop new knowledge in areas where there is a substantial need for knowledge and innovation, and to support the institution's R&D and innovation strategy.

94 grants were delivered during the period 2014-2017. The Study on Fostering Industrial Talents in Research at European Level identified various types of institutions that participated in the scheme. Among those were local authorities, state institutions (government offices working on tackling unemployment, and social security and pension-related matters), organisations in the educational sector, such as state institutions dealing with special needs pupils. A national environmental agency also has some ongoing research projects, and some museums in the cultural sector have also participated in the scheme[297].

Good practices: various good practices were identified as regards the OFFPHD schemes, there are as follows:

- Scheme design - the scheme is structured in a way that the public sector institution is required to apply directly rather than the prospective PhD student making an application to the academic institution directly. The underlying rationale is that this requires both the future PhD researcher and the institution they work for to think carefully during the application process about how they will address problems and challenges specific to the public institution concerned.
- The requirement in the eligibility criteria for the public institution and their academic institutional partner on the research project to develop a joint research plan which is regularly monitored is helping to create sustainable partnerships between academic research communities and public institutions focused on strategic challenges.
- The requirement for applicants to demonstrate how the research project will contribute to strengthening research capacity within the public institution should over the medium-longer term help to develop the public sector's capacity to deliver innovation.

Lessons learned/transferability: There appears to be growing interest in the role of high-quality researchers in addressing the strategic problems faced by different types of public sector institutions. Other similar schemes do indeed address similar issues. For instance, Industrial Postdoc Programme in Denmark and the 'Research Fellowships for Economists' at the Bank of Italy offer similar opportunities. This suggests that this scheme could be replicated in other EU countries.

A second further example was received from Ghent University (Belgium) related to the role of Interdisciplinary Consortia coordinators. This is a variation of IOF for the social sciences and humanities (SSH) and more focused on the knowledge broker role. An example is provided in the box below:

Ghent University's Interdisciplinary Consortia coordinators

Scheme title - InterDisciplinary Consortia (IDC) focused on (societal) impact.

Description: Each IDC has an IDC coordinator. It forms an alternative career path for postdoctoral researchers within the University of Ghent that fits well within the broader remit of the university. The coordinator has an intermediary role acting as a knowledge broker, complementary to the function of an academic researcher. The introduction of this new

[297] European Commission. (2018). *Study on Fostering Industrial Talents in Research at European Level* – Available at: https://cdn5.euraxess.org/sites/default/files/policy_library/final_report_intersectoral_mobility.pdf

Ghent University's Interdisciplinary Consortia coordinators
intermediary function comes on top of the existing framework within the university. The IDC initiative adds to the diversification of roles and represents a much-needed link between research, university administration and policy. **Objectives:** Strategic cooperation through the formation of IDC focussed on realising societal impacts. **Eligibility and formation of consortia.** The IDC are working across faculties, departments and disciplines, focussing on pathways to impact. By doing this, they implement interdisciplinary research collaboration at a university-wide level, including within H2020-projects and other collaborative project types. The opportunities for interdisciplinary research collaboration at national/regional level are focussing on project types like SBO-M (FWO), FedTwins (BELSPO) and Brains (BELSPO) on top of the BOF GOA projects within Ghent University. **Funding and selection criteria:** They are funded by the Special Research Fund, complementing the more traditional business development networks (Industrial Research Fund). They are selected by a panel including societal stakeholders (double review: dossier & interview) and are regularly evaluated based on a case study approach (qualitative). **Replicability / transferability potential:** the scheme could potentially be replicated. The feasibility and desirability of creating an MSCA for researchers working in an IDC-like context and for IDC-coordinators themselves to strengthen interdisciplinarity and diversify roles within universities that are in continuous transformation could be considered. **Sources of further information and contacts:** EU Office of the Research Department of Ghent University, https://www.ugent.be/en/research/research-ugent/trackrecord/idcs.htm

It should be pointed out that whilst there remains much to be done to strengthen the role of knowledge brokers within universities in structuring cooperation with other sectors, the concept itself is not new.

Thirdly, an example of how transnational collaborative research can be fostered with a strong sectoral and networking focus is now provided. The example is part of the "European Universities Initiative" (EIU).

EUTOPIA network
Scheme title: EUTOPIA network **Description:** EUTOPIA is an alliance of six European Universities creating a connected, inclusive community. Through collaborative research, greater student and teacher mobility and shared innovations, among others, EUTOPIA seeks to address local and global challenges, ultimately contributing to creating a new model for higher education in Europe. In June 2019, EUTOPIA was chosen as one of the 17 winning projects throughout Europe in the new "European Universities Initiative" (EIU) competitive call, launched by the European Commission in order to build a European Education Area. **Objectives:** The universities will offer grants to 76 post-doctoral researchers over five years, who will be involved in international collaborative research and teaching, work with local governments and businesses, and collaborate across international divides and traditional disciplinary boundaries. Their work would also be aligned with local governments, not-for-profit organisations, and the private sector to deliver real benefits to society. **Funding and integration with the innovation ecosystem:** Currently, EUTOPIA is launching a postdoctoral programme for early-career researchers working on data and artificial intelligence, health and disease, and energy and sustainability. The programme is worth €10.2 million, with €5.6 million coming from EU's Horizon 2020 programme and another €4.6 million put forward by the universities in the alliance. Fellows will have access to expert mentoring and state-of-the-art research infrastructure. More than 45 companies, local authorities and non-profit organizations will train or host researchers on secondments to support the programme. **Replicability / transferability potential:** the scheme could potentially be replicated by fostering the creation of similar networks where the goals are not only about training outcomes,

EUTOPIA network

but also about societal impact. The networks do not have to be transnational; the important aspects are that their programmes are agreed upon with actors of the innovation ecosystem, and that these actors participate in and support the programme.

Sources of further information and contacts:

For more information, please see: https://eutopia-university.eu/

Another case illustrates how a transnational group of universities, the Coimbra Group, mostly based in small or medium-sized cities, have embraced their potential to play a central role in their surrounding ecosystems through a structured cooperation framework, the "Poitiers Declaration".

A Formal Framework for cooperation between Universities and Cities: the "Poitiers Declaration" from Coimbra Group of Universities[298]

Objectives: The Poitiers Declaration is a document defining a collaborative framework for Coimbra Group Universities and the Municipalities in which they are situated, including a set of objectives and accompanying initiatives to be pursued. It was initiated in June 2016 in Poitiers. The Declaration by Rectors and City mayors reaffirms the central role that Universities play in the development of cities, with cities providing a formative context and functioning as a catalyst for the development of universities. This is especially the case for Coimbra Group Universities, which, mostly being located in small or medium-sized cities, have a close and synergetic relationship with their surrounding ecosystem, thus creating strong and positive dynamics affecting socio-economic development, cultural and civic life, transfer of knowledge and innovation, urban policy and inclusion.

Description of activities: Based on the commitment expressed in the signing of the Poitiers Declaration, each Coimbra Group Member University is encouraged to enhance and strengthen the dialogue and partnership with its municipality. The Coimbra Group has a mandate to examine in depth and in a structured manner the initiatives developed by member universities, in order to serve as a common platform for sharing experiences, good practices and innovative initiatives in the field of University-City partnership.

A recent example of such a common platform is the Coimbra Group High-level Workshop on "The role of universities as drivers of change in regions and cities" held on 8 October 2019 in Brussels at the Permanent Representation of the Czech Republic to the European Union. This workshop explored the role of universities in innovation ecosystems and presented successful examples of university-city partnerships aiming to engage in a dialogue with policy makers and other relevant stakeholders on how to improve synergies to foster the social, cultural and economic wealth of regions and cities. More specifically, the debate focused on "European Innovation Ecosystems" under Pillar 3 of Horizon Europe (Open Innovation) and synergies between funding schemes at different levels, the characteristics of effective innovation ecosystems, and how the interplay among the various actors, in particular universities and municipalities, can be improved.

Lessons learned/transferability: The (Coimbra Group) Universities have a long-standing central role in the development of cities and are strong contributors to the development of their local and regional communities, in particular by making the Knowledge Square (education, research innovation and service to society) a reality. Universities have therefore a fundamental role in the generation of greater wealth and the realization of wider social cohesion: as such, they are key actors, if not leaders, of European innovation ecosystems.

[298] The Coimbra Group of Universities, founded in 1985, is an association of 40 long-established European comprehensive, multidisciplinary universities of high international standard committed to creating special academic and cultural ties in order to promote, for the benefits of its members, internationalisation, academic collaboration, excellence in learning and research, and service to society. It is also the purpose of the Group to influence European education and research policy and to develop best practice through the mutual exchange of experience. Further information on the Coimbra Group can be found here: https://www.coimbra-group.eu/

A Formal Framework for cooperation between Universities and Cities: the "Poitiers Declaration" from Coimbra Group of Universities[298]

Replicability/transferability potential: The collaborative framework proposed by the Poitiers Declaration of the Coimbra Group is accessible to any University and City willing to jointly develop an ecosystem based on the Knowledge Square. The Coimbra Group welcomes any support and initiatives from non-member Universities.

Sources of further information and contacts:
www.coimbra-group.eu
https://www.coimbra-group.eu/poitiers-declaration/
https://www.coimbra-group.eu/wp-content/uploads/Poitiers-Declaration-signed-9-June-2016-1.pdf.

The role of universities in promoting social innovation is illustrated through the next case study.

National Knowledge Platform for Social Innovation – 'Möteplats Social Innovation', Sweden

Objectives: The purpose of 'Möteplats Social Innovation'/ Forum for Social Innovation Sweden (FSIS) is to contribute to the full potential of social innovation, social enterprise and social entrepreneurship as a social force for Sweden in achieving the goals of Agenda 2030 and to continue to be a role model within the field internationally. The goal is to scale and accumulate strength through the knowledge platform in order to increase the development and sharing of knowledge and the possibility for practitioners and potential practitioners within social innovation, social enterprise and social entrepreneurship to meet.

Description: The project partners in the knowledge platform are the Forum for Social Innovation and six regional universities: Jönköping University, Luleå University of Technology, Stockholm University, Umeå University and Örebro University. These higher education institutions (HEI) will host the regional platforms of FSIS. The initiative was started by Umeå University in Malmö back in 2010, but the FSIS project has been scaled up and strengthened in early 2019 to create a national umbrella approach to social innovation with the involvement of other regional university partners and a physical presence in Stockholm. The knowledge platform is supported and co-funded by the Swedish Innovation Agency VINNOVA and involves a number of actors in the different regions in a strong value-chain: Regions, corporations, innovation promoters, HEIs, municipalities, non-profit organisations, authorities and others.

Good practices/expected results and effects: the aim of the project is to enable social innovation to reach its full potential, contributing to the goals in Agenda 2030 and strengthening the competitiveness of Sweden. The results contribute to the operationalising of the national strategy "A sustainable society through social entrepreneurship and social innovation". This is accomplished through the FSIS knowledge platform. With the aid of consistent communication and increased awareness, the project's ambition is to become the unified knowledge platform for social innovation, with possibilities to grow over time.

Sources of further information and contacts:
Maria Collings, Strategic Communication, National FSIS Platform. Maria.collings@mau.se
https://socialinnovation.se/
https://socialinnovation.se/umea-universitet-med-i-storsatsning-pa-social-innovation/

The following two case studies relate to efforts by universities to promote wider societal engagement in science, research and innovation for citizens.

Aligning Research with Societal Challenges – Barcelona's Library Living Lab

Objectives: To encourage innovation and co-creation between researchers and the public, focusing on nine key themes in digital and educational transformation.

Description: The Library Living Lab, based at the Universitat Autónoma de Barcelona (UAB) exemplifies the infrastructures for citizen science that have been developing across the EU. UAB's

Aligning Research with Societal Challenges – Barcelona's Library Living Lab

Library Living Lab is coordinated by the Computer Vision Centre, UAB, and Sant Cugat del Vallès Municipality, with additional integration of Volpelleres neighbourhood and the Barcelona Provincial Council. Its key focus areas include educational apps, linking physical and digital, novel paradigms & storytelling, and revalorising digital connections. These focus areas reflect the current, real social challenges the Lab aims to address through constant stakeholder collaboration and innovation. An activity can only take place at the Library Living Lab if it addresses three basic points:

1. A current social challenge
2. A specific innovation action, such as a novel service or use of an existing technology, or a prototype.
3. A measurable return to society, such as a refined prototype, open source code, etc.[299]

Key achievements/lessons learned: There is a clear research-academia-society bond in place, and the activities that take place at the lab stem from this robust cooperation. For example, there are ongoing open workshops, such as one on 3D scanning a local historical landmark, branded as "Citizens Co-Creating the City's Cultural Heritage"; there have also been one-off events on a range of subjects, from neuroscience and memory to digital skills training.[300] The Lab demonstrates how universities can focus on work that directly benefits local communities, while providing members of the public with widely applicable practical skills.

Replicability/transferability potential: In terms of citizen involvement, the Ajuntament de Sant Cugat creates innovative activities and services for its citizens, as well as a space for collaborating on city projects in which citizens are welcome to participate. This can be done in neighbourhoods and cities across the EU.

A further example of a success story, focusing on the concept of building public trust through public engagement, through organising public engagement is provided below.

Building public trust through public engagement – a science day at the University of Stuttgart

Objectives: Building public trust through public engagement.

Description: The German university has been opening its doors once a year to the public in an event called "*Tag der Wissenshaft*" (Science Day). The public is invited to attend, free of charge, various events throughout the day including exhibitions, lectures as well as hands-on experiments and activities. Science days are an opportunity for the university to raise its community profile by sharing stories of its impact on its local community. Stuttgarters are invited to witness how scientific research is performed in the various laboratories on display across the university's campus.

In 2019, The Institute for Textile and Fibre Technologies presented "Smart Textiles", an exhibition where clothing and technology come together. Various innovations were presented as such built-in sensors monitoring the movements of figure skaters. Simultaneously, the lecture "How can machines learn?" dealt with the role of mathematics in machine learning and artificial intelligence.

Key achievements / lessons learned: The university raised its research and scientific profile in the local community. This was seen as having made a contribution to building public trust through proactive public engagement.

Replicability / transferability potential: The research has shown that many universities – in addition to EU-level initiatives such as the ERC's open science day [301] – have embraced the idea of engaging with the public through science days. This suggests strong transferability potential as one means of actively engaging with citizens to foster greater interest in science. However, such

[299] Library Living Lab. http://librarylivinglab.com/
[300] Library Living Lab. http://librarylivinglab.com/
[301] https://erc.europa.eu/event/be-open-science-society-festival

events should only be seen a one dimension as part of a more integrated communications strategy universities may put in place to engage with local communities.

The importance of closer societal engagement and of societally-relevant research is highlighted in the following case study, which was submitted as part of this study process by YERUN, the Young European Research Universities Network.

Name of the Institution:	University of Southern Denmark (SDU)
Theme of the best practice:	Citizen Science Network
Content of the project:	The Network supports and consolidates from a bottom up perspective the SDU strategy of "doing something worth doing, for society, with society" and is working to attract and maintain present and future generations of learners and citizen scientists. The task of the Network is to create social impact by (1) initiating projects aimed at dissolving traditional divisions between research professional, Faculties and the other links in the chain of education and (2) initiating public engagement with science through projects and collaboration with the public including new and established media. The Network aims to support relevant research for and with citizens of high quality and in that way not only differentiate SDU and OUH as institutions but also aims to strengthen the status and legitimacy of research in society including public debate in the media an amongst politicians. (3) Supporting the SDU strategy of working actively with the UN Sustainability Goals (SDGs).
Aim of the project:	• To bring citizens closer to science – and scientists closer to society – with a focus on reciprocity • To broker knowledge sharing about Citizen Science – internally and externally • To open the research process for all citizens across all levels of education and social groups through communication, education and learning.
Results of the project:	Currently the SDU Citizen Science Network have produced a number of results: 1. A number of Citizen Science projects in a partnership between researchers, citizens, media, NGO's and private sector. So far, 7 projects have been completed with 5 more running in 2020. Research areas include dementia, active living, sustainability and end of life e-products, narrative medicine and projects with in natural science. 2. The creation of a Citizen Science Talent Programme for Masters' Students (20+10 ECTS) 3. A national Library project 4. Advocacy and organizational learning through workshops, masterclasses etc.
Challenges in implementing the project:	Citizen Science at SDU currently face a number of challenges: 1. A framework of funding, primarily on the local, regional and national level 2. Organizational commitment and governance 3. A revised SDU Open Science policy (see 1+2) 4. IT and programming skills 5. Data brokers

Name of the Institution:	University of Southern Denmark (SDU)
Costs of the project:	The estimated cost of the project – grants and budget from SDU – for 2020 is app. 250.000 EUR
Project coordinator contact details:	Thomas Kaarsted, Deputy Library Director (thk@bib.sdu.dk)

Lastly, an example is provided drawing on HEInnovate, a self-assessment tool for Higher Education Institutions who wish to explore their innovative potential. The short example illustrates the characteristics of an entrepreneurial and innovative higher education institution. The initiative was started in Horizon 2020 and will be continued in Horizon Europe.

HEInnovate
Objectives: To support entrepreneurial universities, and better enable them to measure their impact. **Description:** the European Commission, supported by the OECD, has developed "HEInnovate", a self-assessment tool for higher education institutions who wish to explore their innovative potential. It guides them through a process of identification, prioritization and action planning in eight key areas. HEInnovate also diagnoses areas of strengths and weaknesses, opens up discussion and debate on the entrepreneurial / innovative nature of universities as institutions and allows them to compare and contrast the evolution over time. This tool was seen as useful as it means that there can be instant access to results, learning materials and a pool of experts.[302] HEInnovate has highlighted eight characteristics that an entrepreneurial and innovative higher education institution embodies. These would relate to any university following the three models just described or, indeed, following another model or no model at all. They relate to: • Leadership and governance; • Organisational capacity: funding, people incentives; • Entrepreneurial teaching and learning; • Preparing and supporting entrepreneurs; • Digital transformation and capability; • Knowledge exchange and collaboration; • The internationalised institution; • Measuring impact.[303]

4.6.5 Possible actions

Possible actions to foster broader and more institutionalised cooperation between academia, the public and third sector, as well as government are now outlined.

EU level

Incentive and reward practices should be put in place for Universities and other stakeholders to accelerate their cultural change and adoption of novel cooperation and co-creation practices.

There is a need to support the establishment within universities of intermediaries that could fulfil a knowledge brokerage type function (knowledge brokering positions), and staff to resource these positions (e.g. promoting the recruitment of knowledge brokers). Alternatively, the role of Technology Transfer Offices and Industrial Liaison Offices could be expanded, which exist in many universities and include a broader role in fostering intersectoral cooperation, and facilitating practical aspects of this, as well as advising on

[302] HEInnovate (n.d.). [Online] [Accessed 15 May 2020]. Available at: https://heinnovate.eu/en
[303] HEInnovate (2018), The Entrepreneurial and Innovative Higher Education Institution: A Review of the Concept and its Relevance Today. Available at: The Entrepreneurial and Innovative Higher Education Institution: A Review of the Concept and its Relevance Today

IPR management and IP-sharing arrangements in the case of joint, collaborative research projects.

Regarding knowledge ecosystems, the EU already plays a role in supporting the structuring of ecosystems, for instance, through the EIT's Knowledge and Innovation Centres (KICs). Additional EU funding could be made available in Horizon Europe through the newly-established EIC to foster such eco-systems such that these can be extended to a broader range of universities. These could in turn be connected to broader, transnational ecosystems. As the EIC is a new instrument, which has been allocated a significant budget in Horizon Europe, the EIC could pioneer new and effective ways at fostering university-business collaboration to bring about economic and social innovation.

The role of EU funding programmes (e.g. the MSCA, the EIT's KICs, the SME associate pilot scheme and the EIC Accelerator) etc. in promoting entrepreneurship could be further evaluated to make them more effective and well targeted. These schemes combine not only an entrepreneurship aspect but also provide intersectoral and international mobility opportunities for researchers which universities could benefit from.

The EU should provide support for intersectoral mobility from academia to other sectors as a means of encouraging greater mobility of researchers between sectors, and as a way of incentivising more strategic and structured cooperation. For example, career mobility between academia and the third sector could be strengthened by establishing novel schemes that promote such cross-sector mobility.[304] The setting up of mobility schemes could help to drive more structured cooperation with other sectors. This can build beyond individual participant researchers and cover strategic cooperation e.g. between universities and government/public sector, universities and non-profit sector (NGOs and CSOs).

Soft initiatives could be supported at EU level to encourage greater citizen and public engagement in science, and also to help maximise societal impacts. These include:

- Developing metrics, intelligence, and data infrastructures for citizen science and public engagement;
- Including Responsible Research and Innovation (RRI) and citizen engagement activities in criteria for university rankings;
- Identifying and promoting best practice; and creating EU-level tools and platforms for citizen and societal engagement;
- Creating platforms for engagement, as they support continuous dialogue between stakeholders at various levels, including citizens, and bolster innovation ecosystems.[305]

The EU should support policy measures and funding initiatives to increase citizens' involvement in Horizon Europe. However, careful reflection will be needed regarding the possible broadening of stakeholder involvement in at least some Horizon Europe projects. Furthermore, a discussion on tools for maximising the RTD RPs' contributions to achieving societal impacts is necessary.

[304] The Case Study report on Fostering Industrial Talents in Research at European Level, to which CSES contributed, revealed that such schemes do exist. Similar schemes should be promoted. European Commission. (2018). Study on Fostering Industrial Talents in Research at European Level. Available at: https://cdn5.euraxess.org/sites/default/files/policy_library/final_report_intersectoral_mobility.pdf

[305] EUA. (2018). *The future of innovation ecosystems: recommendations from the European Smart Specialisation Workshop*. EUA. https://eua.eu/downloads/publications/the%20future%20of%20innovation%20ecosystems.pdf

Consideration should be given to the introduction of Societal Readiness Levels as a complementing tool to support the existing Technology Readiness Level structure in Horizon Europe. However, this would need to be implemented in a non-prescriptive and flexible way, such as not to pre-determine research activities or outcomes.

Rather, the purpose should be to broaden the TRL concept, given the increased desire from many stakeholders for the FPs to strengthen R&I impacts generally, and societal impacts in particular. SRLs could therefore provide an overall conceptual and analytical framework, with stakeholders participating in the FPs - including universities – having autonomy to determine 1) how best societal impacts could be demonstrated and maximised at proposal stage during the project and 2) how societal stakeholders could be involved in projects, where relevant. This could help to strengthen co-creation and cooperation with a broader range of societal stakeholders.

Good practice guidance could also be developed funded at EU level on IPR for universities. This will have to be sufficiently flexible for universities to be able to adapt and apply approaches to IPR management and cooperation with other sectors that does not deter intra-sectoral cooperation. Any such IPR guidance would need to highlight different alternative models and approaches (supported by case study examples) as a 'one size fits all' approach would be inappropriate. It would also need to strike a balance between the need to protect intellectual property where appropriate, whilst recognising the strategic benefits of open science and innovation approaches, where there is a trade-off to be made. Considerations about which research results should be shared, how fully, and what should remain protected, for instance due to being commercially sensitive, and for how long, are crucial in this context. Potential solutions in this regard are presented in the TM on open science (see Section 4.7).

At **national level,** regulatory frameworks could be revised to better enable the integration of the academic and non-academic sectors. For instance, researchers and academics taking part in mobility periods in other sectors need to have this recognised and valued by their university, including in career appraisal systems (reference should also be made here to the human capital section). Career assessment could include indicators that are also based on the degree of effort of the researcher in promoting the transfer of knowledge (to other sectors, to society). This could help to shift mind-sets towards fostering different types of innovation (including social innovation), rather than only rewarding technological innovation and the commercialisation of research. Reform of career appraisal and incentives systems for researchers could be undertaken in a way that promotes three objectives in parallel (1) intersectoral collaboration, (2) knowledge transfer and (3) the circulation of talents from academia to other sectors, and vice versa.

New and novel funding models could also enable co-operation, co-creation, inter-disciplinary, and trans-sectoral permeability, and also support the creation of appropriate reward systems.

Turning to the **university level,** a number of actions could be taken. Firstly, universities themselves might establish new internal structures to increase the integration and links among different stakeholders. More universities in Europe need to put in place appropriate structures to facilitate intersectoral cooperation, and to ensure that these are appropriately resourced. For instance, the achievements of the TTOs and ILOs in forging a bridge between universities and industry could be built upon and awareness about the existence of TTOs promoted. [306] This is a challenge that will need to be overcome if universities are to engage in third mission activities more systematically.

[306] Guerrero, M., Urbano, D., Fayolle, A., Klofsten, M. and Mian, S. (2016). Entrepreneurial universities: emerging models in the new social and economic landscape. Small Business Economics, 47(3), 551-563.Available at: https://link.springer.com/article/10.1007/s11187-016-9755-4 / The study also draws on

In addition, new cooperation models could be developed supported by intermediary structures such as knowledge brokers to help universities to better manage, structure and institutionalise their relationships with stakeholders in other sectors. Potential examples in this regard are:

1. Supporting translational research centres (as per the example presented earlier in TM5). The challenge is in finding new governance models/national legislative/regulatory frameworks that would allow such forms of collaboration.
2. The setting up of reflection spaces on university premises where NGO practitioners and other civil society actors could be invited. These spaces would contribute to fostering knowledge exchange and facilitate knowledge creation. These measures could serve as the basis for the transformation of universities into development hubs[307].

See example: Brunel Co-Innovate (two initiatives to provide innovation support to London SMEs jointly funded by Brunel University London and ERDF:

- Bridging the gap: supporting London-based newly emerged innovative start-ups to launch, scale and grow.
- Co-Innovate Journeys: connecting SMEs to the academic expertise, innovation specialists and knowledge resources found within Brunel and support new product or service innovation.

Secondly, universities should embrace a participative culture and seek to make intersectoral cooperation the norm, rather than the exception. Possible existing differences within the academic hierarchic context regarding the perceived importance of being involved in third mission activities are also important elements to consider. Indeed, Bienkowska et al. (2016) have shown that the university environment was generally perceived by PhD students in the Health Sciences and Arts/Humanities as rather supportive towards third mission activities with the exception of middle decision levels (department and division levels). [308] The highest (rectors office and its administrates) and the lowest hierarchical levels (research centres and groups) were found to be the most supportive of academic engagement in external collaboration. This suggests that 'bottom-up' as well as 'top-down' processes are important to consider when supporting and developing the third mission activities.

An important means of strengthening their links with other sectors is the role of intersectoral mobility in fostering the physical and/or virtual mobility of researchers. This will provide a mechanism for developing more strategic cooperation between universities and other sectors.

Thirdly, regarding universities' possible greater participation in the Policy Support Facility in future, it would be valuable for universities to be able to more directly influence the agenda-setting. For example, as central anchors in collaborative ecosystems, universities could determine which types of policy-related studies might be needed in a particular country so as to strengthen its national ecosystem. This is the kind of radical approach needed for universities to instigate change and to support them in achieving the ERA objectives.

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secondary data from a study by Huyghe, A., Knockaert, M., Piva, E., & Wright, M. (2016). Are researchers deliberately bypassing the technology transfer office? An analysis of TTO awareness. Small Business Economics

[307] Hansen, J. A., & Lehmann, M. (2006). Agents of change - universities as development hubs. *Journal of Cleaner Production*, 14(9-11), 820-829. The authors conclude that "universities and university consortia can play important roles as hubs in the process to enhance national innovation systems with sustainable development at the top of their agenda". pg. 828.

[308] Bienkowska, D., Klofsten, M., & Rasmussen, E. (2016). PhD students in the entrepreneurial university-Perceived support for academic entrepreneurship. *European Journal of Education*, 51(1), 56-72.

Finally, barriers to maximising the role of universities in strengthening social innovation could be overcome by bridging the gap between universities and societal factors via knowledge exchange at local and regional levels.

In order to help transform universities to strengthen their involvement and engagement in social innovation, universities should:[309]

- More regularly and actively engage with stakeholders from other sectors to identify relevant opportunities for collaborative research projects in the field of social innovation, as strengthening universities capacities in the area has strong potential to improve their contribution to the societal challenges.
- Identify specific opportunities and methods for knowledge exchange to support social innovation, like socially entrepreneurial mind-sets, transferable skills, transversal skills, even new professional profiles.
- Facilitate the exchange, flow and co-creation of knowledge between universities and with social innovators, as well as with commercial and technological innovators.
- Set up a Social Innovation Unit within the university that combines a series of tools and services to support social innovators of the whole ecosystem, both within and outside the university (public authorities, SMEs, NGOs, citizens' associations, etc.), following a multidisciplinary approach (combining for example engineering, social sciences, health, etc.) and thereby enhance universities' contribution to societal transformation.

Universities should seek to create more research proposals collaboratively harnessing the research strengths of different sectors, like the Collaborative Projects funded under the H2020 programming period for 2014-2020[310]. This applies to interdisciplinary-constructed research proposals but should also go beyond academia and include other actors taking on an active role from the outset of the process. This would ensure that research is relevant not only to academics but also to local communities and key intermediaries such as NGOs and other non-profit sector stakeholders.

Turning to possible actions to stimulate citizen and societal engagement, at each governance level, universities can influence local communities and localities in other countries where their researchers undertake fieldwork; Member States and national governing bodies can influence their state as a whole, while facilitating the establishment of new, and reinforcement of existing partnerships across the EU. The EU institutions can provide funding support and encourage the wider dissemination of good practices on citizen and societal engagement both across the EU and within their own institutions.

A University Industry Innovation Network's position paper argues that when addressing lower-performing countries and institutions, societal engagement can not only connect researchers in these institutions to the populations their work may affect, but also demonstrate the applicability of their research to the international community.[311] At the national level, increased participation in these activities can be encouraged 'by introducing more competitive salary levels and performance-based funding, e.g. by requiring staff to bring 30-50% of their salaries from external sources or alternatively establishing 9-month positions with an obligation to bring the funding for remaining three months as competitive

[309] Some of these suggestions emanate from the consultation feedback process with relevant Commission officials responsible for social innovation policies at EU level. They are meant to prompt a debate among universities as to how their role could be strengthened, rather than to suggest a prescriptive approach.
[310] http://www.innovarum.es/en/collab-projects/#:~:text=Collaborative%20Projects%20in%20H2020&text=Horizon%202020's%20Collaborative%20Projects%20have,knowledge%20networks%20in%20their%20industries.
[311] Davey, T., Meerman, A., Orazbayeva, B., Redel, M., Galán-Muroz, V., Plewa, C., and Eckert, N. (2018). *The Future of Universities Thoughtbook*. Amsterdam: University Industry Innovation Network.

funds. This would require progress in enhancing institutional autonomy over university finances, payroll and estate and backing this up with appropriate accountability schemes.'[312] National governments should also facilitate collaboration between their "strong" universities and "weak" universities on public engagement via the soft initiatives listed above.

Universities could test new and innovative approaches, either independently or working in cooperation with other universities. There are some key priority actions universities would take the lead on, with the EU and national governments providing support. For example, they should provide a range of opportunities for citizens to interact with researchers and knowledge production itself, and vice versa. There are some impressive successful examples in this regard that can be highlighted both EU level initiatives and those from individual universities. For example, the **European Researchers' Night** is a high-profile action where science is brought closer to the public and citizens. Further examples are the current re@ct pilot project being implemented in Belgium (Science is Wonderful! in Brussels) and actions already being implemented by the JRC (collaborations with Science Museums; the Arts, Science and Society (SciArt) initiative; the Outreach Programme for Schools; and the Citizen space at JRC-Ispra. An example is provided of the extent of participation in the events linked to this programme below:

The effectiveness and experiences of young researchers taking part in the European Researchers' Night has been considered in a research paper drawing on 12 years' data from Frascati, Italy, which brings together several thousand scientists, eight research institutes and three universities.[313] In each year from 2006 to 2017, the European Researchers' Night attendees for the Italian project organised by Frascati Scienza (https://www.frascatiscienza.it/) has grown, with total attendees over this period of more than 50,000, with about 400 different activities offered and 1800 researchers actively involved in the organization and realisation of scientific activities. A different theme was selected in each year.

The same research paper notes that the scale of the European Researchers' Night is significant as it has involved more than 300 cities in all Member States, with about 40 projects/year funded with a budget of approximately 4 million EUR /year, which increased to 6 million EUR /year from 2018.

In implementing this sub-module, it will be important not to duplicate what already exists and is being funded through the MSCA. In addition, future planned initiatives should be considered, such as the MSCA Researchers at Schools initiative. This initiative should be launched in 2021, and will build on a pilot project implemented in Belgium only. It is also an initiative that may be mentioned in the future Communication on the European Education Area. Nonetheless, this substantial body of good practice initiatives from the EU level could be emulated at the individual university level in an even wider range of universities in future.

Further examples proposed by the ACA include setting up interactive exhibition centres to showcase scientific research being undertaken by universities, and appointing young researcher ambassadors to secondary schools.[314] Universities can also bring about cultural change within their institutions, through training researchers to work more closely with society and by evaluating their own performance in this field. This would be part of a societal impact agenda, implemented and revised at the beginning of each academic year,

[312] Puukka, J. (2018). *Spreading Excellence & Widening Participation in Horizon 2020*. Brussels: European Commission.
[313] 12 Years of Data, Results and Experiences in the European Researchers' Night Project, The National Laboratory of Frascati (LNF), part of the Italian National Institute for Nuclear Physics (INFN), G. Mazzitelli, S. Arnone1, M. Bramato, I. Capra, G. Ciocca, A. Della Ceca, R. Giovanditti, C. Grasso, D. Maselli, G. Sanzone, D. Sereni and F. Spagnoli, https://arxiv.org/ftp/arxiv/papers/1902/1902.03893.pdf
[314] ACA. (2020). *ACA input paper: Towards a 2030 Vision on the Future of Universities in Europe*.

in which the ultimate goal of any research should be how it will benefit—or at least impact—society. Research grants, degree programme applications, and other activities such as internships or post-doctorate positions would then include criteria to this effect.

4.7 TM6: Knowledge-driven universities in the context of digital changes – the transition to open science (through FAIR and open data) and Open Access

4.7.1 Introduction

The term "Open Science" (OS) refers broadly to the scientific creation of "transparent and accessible knowledge that is shared and developed through collaborative networks".[315] The term specifically refers to a movement in the scientific community that envisions a "general shift towards a more open, collaborative, data-intensive and networked way of doing research and sharing research results" that "supports the early sharing of research outputs in open access modes, empowers the participation of non-academic scientists in the research process (e.g. citizen scientists), and promotes an active engagement with the public".[316] The goal of Open Science is ultimately to open up the research process, increase collaboration and make research results more reproducible. This practice can significantly contribute to addressing grand societal challenges. The Covid-19 crisis has brought about unprecedented international collaboration and sharing of data never seen before on such a wide scale.

Open Science consists of a wide range of research practices that cover the entire research lifecycle. These include sharing research methodologies and protocols, making research data accessible, making publications Open Access, societal engagement at all stages of research including citizen science, making peer review transparent, and openly pre-printing and publishing research reports. The concept of 'open' should not be interpreted as a black-white dichotomy of either open versus closed, but rather a spectrum of opening up research activities and outputs that is dependent upon the sensitivity of the research, the ability to make the research open, the urgency to access the research results, and the nature of any funding regulations. There are valid reasons for keeping research results closed or embargoed such as for privacy or intellectual property rights.

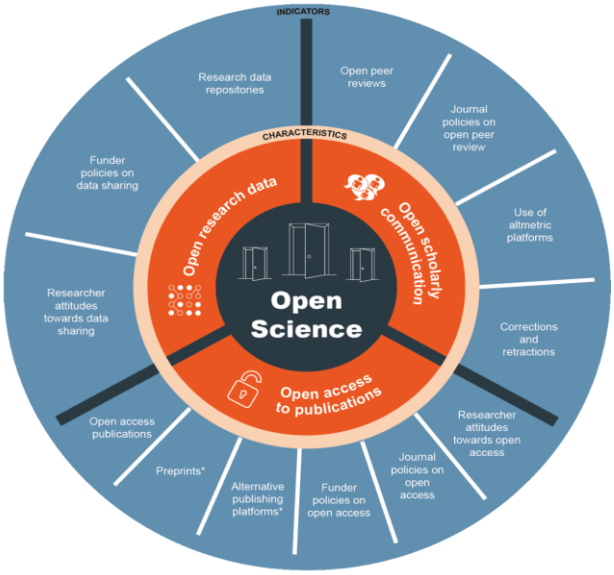
A 2018 research paper by LERU notes that embracing Open Science will require cultural change as regards "the way stakeholders in the research, education and knowledge exchange communities create, store, share and deliver the outputs of their activity. For universities and other stakeholders to embrace Open Science principles, policies and practices, there needs to be a culture change in these organisations if this transition is to be successfully negotiated".[317]

It is important to recognise that universities have already made great progress in moving to Open Science through provision of Open Access repositories and skills training for researchers. Indeed, many universities were engaged in open science activities well before funding agencies. For example, open sharing of large data sets is a long-standing approach in astronomy and the social sciences. However, there are limits to their ability that depend strongly on external factors that are both regulatory and financial. Europe is leading globally on Open Science with major initiatives including Plan S and the European Open Science Cloud (EOSC)[318].

[315] Vicente-Saez, R., Martinez-Fuentes, C., (2018). "Open Science now: A systematic literature review for an integrated definition". Journal of Business Research. 88: 428–436. doi:10.1016/j.jbusres.2017.12.043.
[316] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018SC0307&from=EN
[317] Open Science and its role in universities: A roadmap for cultural change, LERU, 2018: https://www.leru.org/files/LERU-AP24-Open-Science-full-paper.pdf
[318] https://www.coalition-s.org/why-plan-s/

The transition to widespread adoption of Open Science practices for universities requires changes that permeates a wide range of academic activities from institutional to individual. The range of issues that must be addressed are illustrated in Figure 1 below.

Figure 4-3 - Open Science "Wheel", describing key Open Science characteristics and indicators (from the Open Science Monitor).



In terms of the broader vision for universities, by 2030, there will have been a transition across universities to Open Science that permeates all of their activities. There will be a culture of openness among researchers at all levels (R1-R4) that includes open access to publications, open access to data, including FAIR and open data, open peer review, research integrity and citizen science. This will also be integrated into the education of students. Recruitment and progression of researchers will be done using broad assessment criteria taking into account a range of competences and practices including Open Science. Knowledge circulation to the economy and society will be driven by open science according to the principle of 'as open as possible but as closed as necessary'. There will be greater transparency, reproducibility, dissemination of research and transfer of new knowledge. There will be greater trust by citizens in knowledge produced by universities through collaboration (citizen science) and open access to research results and their implications. However, in order to realise this vision, there are challenges that must be addressed.

4.7.2 Challenges

Challenge 1: The culture and governance of universities does not always support open science.

The governance of universities is diverse across, and often within, the EU Member States. This diversity means that instances of good practice have emerged, but more comprehensive efforts are needed for a culture of open science to become firmly rooted across Europe's universities. The Commission's High-Level Advisory Group of the Open Science Policy Platform has identified the need for an alignment of the Open Science policy agenda across all stakeholders involved[319]. There is also an identified need for the scholarly communication "ecosystem" to have the tools and research community practices necessary for Open Science publishing. An important factor in all of this is the extent to which the requirements of funding tend to promote or discourage Open Science.

There is a lack of wide university led multilateral action towards Open Science across Europe. At global level, there is a lack reciprocity among universities and funders that

[319] https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-policy-platform

could lead to an open Europe but closed world. In that context, there is the need for security to ensure that critical European research output is not exploited in other countries.

Challenge 2: The systems of rewarding researchers tend not to incentivise the practice of Open Science.

The current system of evaluating academic careers, research work and universities, tend to prioritise publication in high-impact journals i.e. by prioritising the Journal Impact Factor (JIF)[320] (also see Section 4.5.2). Yet it is clear from previous studies that JIF is not a reliable proxy for the quality of research published, but rather a proxy for the 'prestige' of journals in which the research results are published, which often costs universities and research institutions a great deal of resources to publish in. It is inappropriate that individual researchers are simply judged on where they publish[321]. This is caused in part by funders continuing to use narrow metrics in the individual peer review process and by universities continuing to use narrow metrics in the recruitment process and career progression. This is despite the concerns expressed in some literature regarding the use of the JIF and h-index [322] for the accurate assessment of a university's overall research performance. An effort has been to strengthen good practices in bibliometrics analysis through the Leiden Manifesto for research metrics. [323] The Manifesto includes key principles such as "Quantitative evaluation should support qualitative, expert assessment" and "Measure performance against the research missions of the institution, group or researcher". This could help to overcome over-simplification in the use of bibliometric data, such as the JIF and h-index.

Moreover, whilst many universities have signed up to the San Francisco Declaration on Research Assessment (DORA), as pointed out in 4.5.2, few have moved to implementation (only 15% according to EUA survey[324]). Researchers and universities can therefore be reluctant to engage if there is the perception that they will be disadvantaged in job and funding applications or international rankings. There is also the tendency for the established research community towards not accepting a new system as they have built their careers on these metrics. This also leads to a reluctance by researchers to engage in open peer review. For Open Science to become mainstream, the embedded culture of closed access and a focus on rewarding researchers for publishing articles into prestigious journals alone will need to be upended through decisive actions.

Challenge 3: The need to increase Open Access publications.

The practice of Open Science has been hindered by the dominance of the market in scientific publishing amongst a limited number of publishers. Whilst these publishers embrace some aspects of Open Science, they can be reluctant to see their established business models challenged by alternative Open Access models. Moreover, there is often a general distrust of Open Access publications journals given the impression that too many have been seen as low quality or even "predatory". [325] This distrust tends to be aggravated where it can be difficult to identify appropriate high-quality Open Access journals. There

[320] See for example (1) The weakening relationship between the Impact Factor and papers' citations in the digital age - George A. Lozano, Vincent Lariviere, Yves Gingras, Cornell University, https://arxiv.org/abs/1205.4328 (2) The New Metrics: Practical Assessment of Research Impact, edited by Elaine M. Lasda, and (3) The Journal Impact Factor: A brief history, critique, and discussion of adverse effects, Vincent Larivière & Cassidy R. Sugimoto - https://arxiv.org/ftp/arxiv/papers/1801/1801.08992.pdf
[321] EUA Roadmap on Research Assessment in the Transition to Open Science EUA (2018)
[322] The h-index popularised citation counting for individual researchers.
[323] See http://www.leidenmanifesto.org/ and Bibliometrics: The Leiden Manifesto for research metrics, Diana Hicks,Paul Wouters,Ludo Waltman,Sarah de Rijcke& Ismael Rafols
[324] EUA (2019), Research Assessment in the Transition to Open Science, https://eua.eu/resources/publications/888:research-assessment-in-the-transition-to-open-science.html
[325] It is straightforward to assess the quality of OA journals, see for example, https://libguides.bc.edu/journalqual/oajournals

is currently also a lack of recognition of Open Access journals, and corresponding difficulties in encouraging researchers to publish in and participate in peer review processes linked to such journals, as this is not generally recognised in researchers' career development assessment criteria. There are positive developments with Nature joining Plan S through a commitment to offer researchers a route to publishing open access in Nature and most Nature-branded journals from 2021[326]. Recently in the Netherlands, universities and research institutions have begun a national Open Science partnership with the publisher Elsevier[327].

Apart from the traditional publishers, there are many other models of how to transition to Open Access. For example, University College London (UCL) has established its own press that publishes books and journals[328]. There is also the revolutionary bottom up approach where the editorial board of the journal LINGUA created a new Open Access journal GLOSSA that has effectively replaced the former[329].

An interesting model for future scholarly publishing could include OA pub platforms that have no author facing fees (free to read/publish), that have platforms built upon Open Infrastructure principles, and that open up the research publication workflow to include preprints and open peer review reports and open metrics.

Challenge 4: A number of obstacles are tending to hinder FAIR/Open Data practices, including the need for sufficient human and financial resources.

A key barrier to Open Science is the fact that much research data is neither findable nor accessible and is thus often not reusable. This implies that much research data is in fact useless and research results cannot be verified. This not only is a waste of public funding, but can also involve unnecessary duplication of research activities and can hinder creativity that originates from inter-disciplinary approaches, from combining data sets, etc. The first step towards making data open is to make the data to be Findable, Accessible, Interoperable, and Reusable (FAIR). Once the data is in a FAIR format, the researchers can then assess to what extent they need or want to open up their FAIR data sets. However, provision of FAIR and open data can be hindered by a lack of training for researchers on how to actually make their data FAIR and open. There is also insufficient funding for the necessary FAIR and open data infrastructure. Critically, there is a lack of professionals in universities to act as data stewards to curate and manage the data. There is furthermore a need for researchers to have a greater understanding of legal issues surrounding open data (IPR, commercial sensitivity, Privacy and GDPR).

There are significant issues when it comes to funding calls, because Open Access and Data Management Plans (DMPs) are a limited part of the call, meaning that there are insufficient funds in a single call to recruit the relevant staff (x% of a FTE) to manage Open Data. The standard solution is to continuously combine several sources of funds from different grants to recruit permanent staff in this area. To be really effective, universities need to build permanent teams and not rely only on using funds from research grants to maintain Open Science services. Current support is usually centred in the university libraries however this needs to be integrated into an institutional strategy that recognises the core nature of Open Science services, the central role of the library and provides the appropriate support.

[326] https://www.nature.com/articles/d41586-020-01066-5, https://group.springernature.com/gp/group/media/press-releases/springer-nature-plan-s/17877246
[327] https://www.openaccess.nl/en/events/dutch-research-institutions-and-elsevier-initiate-national-open-science-partnership
[328] https://www.uclpress.co.uk
[329] https://www.rooryck.org/lingua-to-glossa

Challenge 5: The need to strengthen Open Science skills training for researchers, and to ensure appropriate funding to allow for the recruitment of support staff

The skills needed for Open Science cover a broad span from data management to ethical and legal aspects. They also include more technical skills, such as data stewardship, data protection, scholarly communication and dissemination, see Figure 1. There is the need for researchers to have a greater understanding of legal issues surrounding open data (IPR, commercial sensitivity, Privacy and GDPR). Moreover, as identified by the OSPP, there is also the need to include training on Research Integrity and Citizen Science[330]. Currently, there is a lack of training for researchers at all levels (R1-R4) and professional staff.

Regarding skills training for researchers, some stakeholders stressed that there is a need to have a more comprehensive approach. Training and capacity-building should also include support staff, who should work closely, and ensure a good continuum with researchers. Researchers cannot achieve any (open) science without strong support. Universities need to recruit support staff to help facilitate open science in the longer term, at the right level of expertise and ensure that this is appropriately remunerated in terms of salary levels. There is also a need to develop higher-level training courses for more senior researchers, who may have extensive research experience, but lack facility in working with and adopting open science practices. Specific training is also needed regarding, for instance, platforms curation, metadata and so on.

However, there are already some forms of support. For instance, there are courses available through the FOSTER[331] OS initiative. Further details about this and other OS initiatives are provided in the following box:

The **FOSTER initiative** (**Facilitate Open Science Training for European Research)** is an e-learning platform that brings together training resources and good practices on OS. This has established and supported a European-wide training programme. This has consisted of more than 100 training events, in 28 countries, with more than 6,000 participants, on Open Access, Open Data and Open Science, consolidating training activities at downstream level and reaching different stakeholders, diverse disciplinary communities and EU Member States and EEA/ EFTA countries taking part in the ERA.

The **Open Science MOOC (**https://opensciencemooc.eu/) bolsters the Open Science training offer and bridges existing training gaps. The initiative is part of a growing call for greater reproducibility of data and increased transparency regarding data provenance) in research. Both initiatives provide access to online and face-to-face training, and create new, and strengthen existing networks and communities of practice.

The **FOSTER Roadmap for Implementing Open Science Training Practices in Research institutions** outlines three key ways and practical actions that can be taken up by universities and other Research Performing Organisations (RPOs) to support the transition towards Open Science (cf. Brinken et al. 2018). RPOs can promote change by advocating skills acquisition and learning. Lobbying for change on all career stages is key to reach senior and junior researchers. They can also ensure access to training materials and courses that facilitate learning and change. Lastly, RPOs can motivate change towards Open Science by providing recognition and reward for those putting Open Science, and other "soft skills" into practice. Open Science is an important knowledge transfer method in a knowledge-based economy and society.

There are additionally some **training courses on OS at national level being delivered in individual universities**, such as the best practice example highlighted in the main report from Leiden University in the Netherlands. However, such courses are few and far between according to the findings of a report by an expert group on OS.[332]

[330] https://ec.europa.eu/research/openscience/pdf/integrated_advice_opspp_recommendations.pdf#view=fit&pagemode=none
[331] https://www.fosteropenscience.eu
[332] Idem. Pg. 10.

It is important that researchers at all levels engage fully in open science. This means that Open Science skills[333] must be appropriately targeted at the different categories of researchers and associated professionals. For example, middle (R3) and senior (R4) researchers should act as leaders to catalyse cultural changes. This will need university and funding agency support through policy and funding. In addition, it will be challenging to engage more senior researchers in training as they are by and large embedded within the current system.

Challenge 6: The tension between pursuing Open Science and managing IPR effectively

Clearly, IPR needs to be protected and exploited where appropriate. This will be the case in varying situations, such as when universities are carrying out contract research for commercial organisations, when there are particular commercial sensitivities regarding the IP of joint research projects between the private sector and universities, and where legal instruments such as Non-disclosure Agreements (NDAs) are involved. However, ensuring that IP is respected and Open Science principles are not mutually incompatible.

As this is a complex area, it is worth summarising some of the existing problems and also the means of overcoming these. In the open science domain, there is an existing parallel to the current system for publications and patents. This is particularly the case when there is public-private research collaboration. Typically, research results in publications are embargoed for a period to allow for exploitation (patents, licensing etc.).

Regarding open science, there are many situations where there are no IPR issues, as curiosity-driven research is societally-oriented and/ or may have no commercial value, at least in the short term. The researchers who produce new data will need the time to exploit that data and to prepare publications. Otherwise, if the data is published openly too early, they could be scooped by larger research teams with more resources to use the data. There is also the aspect (already raised in the report) of exploitation of data produced in Europe being exploited elsewhere and the need for reciprocity of openness.

However, there are different means of navigating this challenge in that Open Science is also about the early sharing of results, rather than waiting for publications before sharing data and other outputs. Sharing data can actually help to make the data more robust and reliable. However, there may be constraints to sharing such data openly prior to publication, such as concerns about IPR (for instance, if research is partially funded by the private sector. Moreover, a strong limiting factor to implementing more open data ahead of publications is the current so-called "publish or perish system" whereby the most common method of the evaluation of researchers is primarily based on the number of publications and their JIF in high-impact journals.

One of the core IP-related issues in relation to open access to publications is that currently, authors sign over their copyright to Journals as part of the copyright policies of academic publishers. The Plan S approach, for example, makes it clear that authors should retain copyright. However, the situation is gradually also changing within academic publishing, as some academic publishers have instituted reforms, whereby even if they retain copyright to articles, most journals allow certain rights to authors (e.g. the ability to reuse parts of the paper in the author's future work, and to allow authors to distribute a limited number of copies (e.g. reprints in hard copies and post prints in electronic format).[334]

[333] Brennan N., Hyllseth B., Kamerlin C.L., Kohl U., **O'Carroll C.,** O'Neill G., van den Berg R., *"Providing researchers with the skills and competencies they need to practise Open Science"*, European Commission, July 2017 (doi: 10.2777/121253).

[334] https://blogs.scientificamerican.com/information-culture/understanding-your-rights-pre-prints-post-prints-and-publisher-versions/

In conclusion, protecting IPR and pursuing Open Science and Open Access to data are not incompatible objectives, but need to be managed carefully by universities. Further reform of copyright rules in academic publishing could help to foster Open Science and data sharing practices.

The issue as to how open the principle of Open Science should be was raised in the stakeholder workshops. For example, in an international context, there are issues around the extent to which Europe should be fully open if others do not reciprocate. In particular, China was mentioned as only selectively pursuing OS practices.

However, there may also be constraints to Open Science, such as those engendered by commercial considerations. A major EU business representative association taking part in the consultation process noted that there are many questions as to when Open Science should be applied, and to what degree. Examples are: (i) research with potential implications for European long-term industrial competitiveness (e.g. quantum computing, quantum communication), research touching the commercial interests of companies (e.g. H2020 projects co-funded by industry), etc.

There are also industries where research is taking place in strategically sensitive sectors, where other jurisdictions globally are investing heavily in R&D&I and provide large grants, such as semiconductors, the space industry etc. It is worth acknowledging in this regard the existence of a "grey area", which may necessitate better guidance for researchers as to which research results and data they should share openly, and which could be shared more selectively. This challenge is also raised in the context of the European Digital Strategy, which introduces the concept of European data sovereignty. There is an issue as to how open Europe should be in sharing its data, unless others offer similar access to their data, and unless it respects European values and norms, such as respecting personal data protection and privacy.

4.7.3 Transformation needs

By 2030, the need is for Open Science to be mainstreamed in universities and permeate all of their activities. There will be a culture of Open Access to research publications, FAIR and open data, and societal engagement with science. Knowledge circulation to the economy and society will be driven by Open Science but tempered by the need for a reciprocity and a global level playing field. A key enabler of Open Science in the future will be the developing European Open Science Cloud (EOSC), as noted recently by the new President of the European Commission[335]. The goal of the EOSC is to create a web of FAIR data and services for Open Science that will help researchers to not only open up their publications, data, and code, but crucially to combine interoperable data sets across disciplines in order to generate new discoveries and tackle complex societal challenges. In order to realise the vision expressed above in 4.8.1, the following transformation needs will be required.

- Building an Open Science vision at universities that encompasses the various practices of Open Science including societal engagement, and coordinates relevant policies, skills training, support staff, and capacities and services. Embedding a culture of Open Science that permeates all aspects of the university and its dealings with society.
- Reforming the assessment of research and academics by universities, and of the institutions themselves, to incentivise and reward the practice of Open Science as universities have the autonomy to set their strategies for evaluating their research and their staff.
- Stimulating researchers to make their publications Open Access, while at the same time encouraging publishers to transition from closed access and on-transparent business models to Open Access and transparent business models. Scholarly publishing

[335] https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_20_102

is to a large extent controlled by a small number of publishers who act in a way as gatekeepers to scientific knowledge. The goal of initiatives such as Plan S and OA2020 is to acknowledge their role in the scientific publishing ecosystem and bring them on board in the transition to OA. Encouraging researchers to participate in the development of Open Access journals by acting as peer reviewers and members of editorial boards.

- Ensuring that data and results generated can be reproduced, trusted and reused, as the issue of reproducibility and reuse of results is a growing concern. Ensuring that local data infrastructure capacities and services are aligned with FAIR data principles and can seamlessly align with the future federated EOSC to create a web of interoperable data sets. Developing and implementing policies and strategies for FAIR data management and training and supporting researchers in transitioning towards this (especially through utilisation of data stewards and data management plans), including by training and supporting researchers and scientific communities in transitioning towards this (especially through utilisation of data stewards and data management plans).
- Ensuring that researchers at all levels have the necessary skills to practise Open Science including open access publishing, open data management, open peer review, research integrity, legal issues and societal engagement. In the broader context ensuring that researchers at all levels have protected time to access these skills and professional development.

4.7.4 Case studies and success stories

An example of a success story is provided below from the University of Liège on Mandating (Green) Open Access.

Mandating (Green) Open Access at the University of Liège

Implementer: University of Liège

Issues: Universities have never been able to afford all the journals and books that their staff and students need to do their research and studies. This limitation of access to publications is exacerbated by the high profit-driven approach of some major scholarly publishers leading to high costs for Open Access. Scientific results ultimately end up locked behind paywalls that only paying institutions and individuals can afford.

Objectives: The university aimed to ensure that the research conducted by their staff and students is given the greatest possible impact and outreach as well as owning a complete repertoire of their scientific results. The goal was to handle scholarly communication in an alternative way that is more widely, democratically, rapidly, and efficiently managed as well as maintaining a permanent institutional repository for publications.

Description of activities: The university created a digital library in 2007 and introduced a mandatory policy for their researchers to deposit the peer reviewed and accepted version of journal articles in the repository. The deposition of conference papers, book chapters, and full books was not mandatory but optional. This policy essentially involved a mandate of 'green' Open Access whereby all journal articles from research done at the university are accessible on the institutional repository and are indexed widely in search engines. The mandate took into account publisher embargoes on green Open Access and did sporadic repository checks. The university presented the mandate and Open Access in a positive light in communications and supported their researchers with information on benefits and practices of Open Access and tools to do Open Access.

Key achievements: The university has achieved a very high level of compliance and is one of the most successful universities in Europe regarding opening up access to their journal articles. A study for the European Commission shows that across institutions more than three quarters of journal articles are not deposited at all, institutions without a mandate have a full-text deposition rate of 7%, and institutions with a mandate have a rate of 17%. The university, which mandates deposition and furthermore crucially links compliance by researchers to career evaluation, has a

Mandating (Green) Open Access at the University of Liège

rate of 87%. The university has also not only greatly increased the visibility and downloads per journal article but also doubled the average number of citations.

Lessons learned: The mandate was primarily successful due to the highly active involvement and dedication of the rector and executive board of the university. Key takeaways on what is needed:(1) high-level support from the university governance (2) positive, clear, and regular communications about Open Access and the reasons and practicalities of the mandate (3) a positive approach showing the benefits of Open Access and linking good practices to career evaluation (4) training and support by the university library for researchers to comply with the mandate. One example of a top researcher at the university being denied promotion due to lack of deposition of historical articles served as a strong message on the seriousness of the mandate. It is worth noting that a strong culture of deposition and Open Science has developed since the initial mandate.

Replicability / transferability potential: The mandating of green Open Access by researchers in alignment with the 'Liège Model' is easily transferable to other universities. Most universities will already have an institutional repository although there may be costs involved to adjust the digital library and train library staff to be able to support researchers to comply with the mandate. The burden of checking that deposited journal articles comply with publisher embargoes and requirements lies with the researchers but the library will need to do regular checks that journal articles are indeed deposited and in compliance with regulations. The implementation of this mandate relies ultimately more on political will than financial or practical issues.

Sources of further information: https://orbi.uliege.be/project?locale=en&id=103

Contact for further information: Bernard Rentier <brentier@uliege.be>

A further relevant example is now provided. The case study focuses on the concept of data stewardship as a means of implementing the FAIR data principles and streamlining data management at university level.

Implementing (FAIR) Data Stewardship at TU Delft

Implementer: TU Delft

Issues: The drive towards an open and collaborative science that addresses societal needs relies crucially on the implementation of research data management practices following FAIR and open principles. The European Commission has estimated that 5% of all research expenditure should be spent on FAIR and open data management and stewardship. The high-level expert group on the European Open Science Cloud has further estimated that half a million data stewards are needed to ensure effective data management. This requires universities to provide expert training and support for their researchers by employing professional data stewards who are disciplinary experts with a knowledge of FAIR data management and Open Science.

Objectives: The university made a strategic decision to be a frontrunner in the global move towards FAIR data management and Open Science and aimed to create a dedicated data stewardship programme. The long-term objective of the programme was to comprehensively address the data management needs across the university in a disciplinary manner by appointing subject-specific data stewards at every faculty. The university also aimed to support the work of the data stewards with the necessary policy changes by allowing each faculty to develop its own policy on data management based on a common policy template. The faculty policies would determine the overarching university data management policy framework as well as the responsibilities of the university support services for the data management and stewardship. A data stewardship coordinator at the central library would lastly create active links between the stewards and ensure consistent and aligned messages as well as allow coherent service development at university level.

Description of activities: The data stewards at each faculty were tasked with advising their researchers on various aspects of data management: analyse data management needs through qualitative interviews and quantitative surveys; provide advice to and answer questions from researchers; liaise with faculty stakeholders to ensure service providers are aware of and aligned with good data stewardship practices; train and inspire researchers in good data management; help researchers comply with funder and journal policies on data management through good data

Implementing (FAIR) Data Stewardship at TU Delft

management plans; develop faculty data management policies through policy consultations with and support to faculties; prepare faculties for the future by informing on policy developments on data management and stewardship; deliver regular reports on the monitoring and evaluating of data management practices in each faculty; liaise with the data stewardship coordinator and other data stewards to exchange good practices and lessons learned and discuss key issues. The data stewards would be professionally dedicated to their data steward role and have disciplinary expertise (reflected in a PhD degree or equivalent experience) in the research area of the respective faculty.

Key achievements: The university started by employing one data steward coordinator at 0.5 FTE at the library and one data steward at 0.5 FTE at each of the eight faculties in 2017 and 2018. The data stewards were recruited as disciplinary experts with various degrees of awareness of good data management practices such as funder requirements and the FAIR guiding principles. A tailored training programmes was developed for the data stewards including workshops given by internal and external experts on local and national ICT provisions, data management planning, use of repositories, benefits of data management, work workflows for working with big data, and principles of Open Science. The data stewards were provided with ways of working, shared project spaces, and communication tools to support their activities and met weekly. The dedicated work of the faculty data stewards was subsequently extended from 0.5 to 1.0 FTE in 2019. The data are investigating and supporting the data management needs of their researchers and are organising regular advocacy events and information sessions at their faculties. The data stewards are also developing advertisement materials, maintaining a blog with regular posts, publishing a newsletter, and engaging with national and international colleagues on the data stewardship programme at the university.

Lessons learned: One of the main challenges was to establish a framework for effective communication and collaboration between the data stewards and the central research data support team. The support team had already been providing services to their researchers and it became crucial that research support tasks were allocated between the two teams and they communicated regularly. A second challenge was to judge the progress of the programme by developing a set of evaluation metrics that would determine if the project was moving towards the goal of improving good data management practices. Both qualitative and quantitative surveys were conducted to evaluate the progress of the programme. A third challenge was the need for more granular disciplinary experts to be truly discipline-specific and deal with the wide diversity in research disciplines and topics within the faculties. The data stewards received further support by departmental data champions who could act as local community advocates for data management in 2018.

Replicability / transferability potential: A data stewardship programme similar to the TU Delft model could be easily implemented at other universities. University libraries already offer research support services which could be further extended with dedicated and professional data stewards. The specifics of the data stewardship programme and the lessons learned at TU Delft are openly available and can be utilised by other universities. A key hurdle for universities is the financial cost of employing, training, and supporting a data coordinator and data stewards at each faculty. This is a policy decision which needs to be taken at the highest level of university governance and politically supported and publicly advocated at the university.

Sources of further information: http://www.ijdc.net/article/view/604/520

Contact for further information: Marta Teperek <m.teperek@tudelft.nl>

4.7.5 Possible actions

A number of different possible actions at EU-level were identified. These EU interventions have been delineated at three different levels:

<u>EU actions, type 1:</u> Incentives based on the rules and practices of the Horizon 2020 and Horizon Europe programmes, and other EU programmes

The EU has considerable influence through its funding programmes, notably Horizon Europe. These programmes can promote Open Science through financing specific activities (such as capacity-building) and through making funding conditional on the adoption of

Open Science practices. An example could be stronger mandates on Open Access such as proposed by Plan S and on the use of data management plans and the necessity for FAIR data. Initiatives to encourage Open Data sharing should be also considered. The EU can pilot funding initiatives in Horizon Europe to embed open science in the various programmes. For example, new methods of individual researcher assessment in the ERC and the Marie Sklodowska Curie Actions (MSCA).

EU actions, type 2: Financial support from the Horizon 2020 and Horizon Europe programmes and other programmes (e.g. cohesion policy), for specific actions in support to OS (capacity building, coordination and support actions)

In the remainder of Horizon 2020 and in the future Horizon Europe, the EU could take a number of steps, such as to:

- Further invest in specific initiatives driving Open Science forward, such as the implementation of the European Open Science Cloud (EOSC).
- Promote understanding and adoption of best practices in Open Science through soft instruments, such as expert panels, studies, mutual-learning, awareness-raising activities and dissemination.
- Guarantee reciprocity in Open Science with Third Countries using Trade Agreements and access to Framework funding as leverage.
- Provide funding support for peer learning exercises, as some universities are behind in transitioning towards Open Science practices whereas in other universities in Europe, a culture of OS has already become institutionally embedded.

Provide additional capacity-building support to enable universities in the EU13 to help them embrace Open Science and Open Access. They could be provided with training support and capacity-building to be able to implement OS through an exchange of experiences and peer learning processes).

EU actions, type 3: Complementary policy actions

The EU could renew charters and codes of conduct to explicitly include Open Science, for example, the European Researchers Charter to explicitly refer to Open Science and a specific Code for Conduct for OS. Also, a renewed Code of Conduct for the Recruitment of Researchers to include a far broader assessment of track record that includes open science (based on OS-CAM).[336]

National-level actions

Member States could also promote Open Science through supportive policy frameworks that allow scope for OS practices in universities and in the broader innovation ecosystem to flourish. They may also be able to encourage, incentivise or (in some cases) require universities to reform career appraisal and incentives systems for researchers in a way that promotes OS practices. Moreover, Member State authorities should not over-rely on the EU for funding support to foster OS practices. Whilst the EU has an important role to play, the Member States should also ensure that the necessary funding is put in place to complete what is required.

Moreover, Member States have an important role to play regarding capacity-building, including in relation to infrastructures and tools, as well as education and skills.

[336] O'Carroll C., Rentier B., Cabello-Valdez C., Metcalfe J., Maes K., Vandevelde K., Halleux I.,Esposito F., Kaunisma E., McAllister D., Brach I., *"Recognition and Reward for Researchers engaging in Open Science"*, European Commission, July 2017 (doi: 10.2777/75255).

They can stimulate the implementation of strategies and policies at national level that allow for open science practices in universities and in the broader innovation ecosystem to flourish.

They can introduce soft measures to support universities to better manage IPR. As explained in TM5, this could consist of the development of good practice guidance on IPR for universities. However, this will necessarily have to recognise the diversity of national legal frameworks.

National funding agencies can introduce funding streams to support universities in implementing of Open Science practices.

University-level actions

Universities can take steps to promote Open Science, including through the reform of their practices around Open Access and FAIR and Open Data, provision of staff training, reform of career appraisal and rewards and incentives systems. Specifically, they can implement the eight priorities identified at EU level to ensure that a sustainable culture of OS takes hold within universities in Europe by 2030. [337]

The funding support needed for sustainable Open Science within universities (and groups of cooperating universities) could be identified.

Further coordination of Open Science through the structuring of research communities already involved and committed to OS. Only a small proportion of universities in Europe are already fully embracing OS. Among those that are leading in this area, there is a need to foster greater coordination, such that capacity might be developed that could then be leveraged to raise the level of all universities in Europe to the level of the most advanced currently in OS.

While universities can reform career incentives and rewards systems, this must be reciprocated by funders of research at national and European levels, and among relevant stakeholders (e.g. universities, publishers and national authorities responsible for higher education and research and innovation).

Research data could be (automatically) opened after the end of the project, for example, 3 years afterwards. This should allow sufficient time for the researchers and IP holders to exploit the research data and the IP. It should be recalled however that FAIR data does not mean open data. Rather, FAIR datasets can be accessed by AI and algorithms that could be given different levels of access.

Universities could develop and implement policies and strategies for FAIR and Open Data management and training and supporting researchers transitioning towards this (especially through utilisation of data stewards and data management plans.

Below there is a list of further detailed actions to be taken at EU, Member State and University level to embed open science practices. The list of examples below is classified under Governance, Incentives and Rewards, Open Access publications, FAIR/Open Data and Open Science Skills.

Governance

- Revising EU rules and conditions on ownership, access on sharing of data, methods and models; including in Horizon Europe (EC, MS)

[337] https://ec.europa.eu/research/openscience/pdf/integrated_advice_opspp_recommendations.pdf#view=fit&pagemode=none

- Provide funding support for peer learning exercises, as some universities are behind in transitioning towards Open Science practices whereas in other universities in Europe, a culture of OS has already become institutionally embedded (EU).
- Improve the smart use of IP for R&I results in the EU, e.g. review of 2008 recommendation on IP management and knowledge transfer (EC, MS).
- Undertake strategic assessment and evaluation of the impacts of Open Science implementation across universities in Europe, of the impacts of universities embracing OS in the EU, and of the effectiveness and impacts of the initiatives for OS (EC, MS).
- Ensure that ethical issues are considered in the use of Artificial Intelligence (AI) technologies as a driver of Open Science. AI has a valuable role to play as a means of monitoring scientific and research impacts as well as exploiting FAIR and Open Data (EC, MS).
- Include operational costs for Open Science as direct costs in EU and national funding programmes (EC, MS).

Incentives and Rewards

- Actively promote moving beyond narrow metrics (e.g. Journal Impact Factor) in research and researchers' assessment, and the wider take-up of the OS-CAM[338] research career assessment matrix, while at the same time recognising the autonomy of universities in determining career appraisal and incentives systems for researchers.
- Reforms of career incentives and rewards systems among relevant stakeholders (e.g. universities, publishers and national authorities responsible for higher education and research and innovation) should be implemented (for instance, as has been coordinated nationally in the Netherlands), and could be facilitated by the EU.
- Adoption of innovative career assessment tools could be used to facilitate university reforms to foster take-up of open science practices (EC, MS, Universities).
- Pilot funding initiatives could be undertaken at EU level (e.g. designed by the Scientific Committee at the European Research Council) and Member State level (national funding agencies) to broaden the criteria for excellence in peer review to incorporate Open Science as part of research funding (EC, MS). The ERC is a recognised leader in research excellence across Europe and could become a paradigm for OS research assessment.
- Pilot initiatives at EU level and Member State level could be introduced to introduce open peer review to the process of research funding. This would encourage Early Career Researchers to engage more in the practice of OS (publishing in OA journals, for example). Ideally, this should be done in parallel with existing peer review processes to compare and contrast the methods (EC). Similar initiatives could be considered by the ERC's Scientific Council, for example, pilot open peer review in ERC funding for Starting Investigator Grants, but only if this is supported by them, fully respecting their independence to determine the evaluation criteria for their own grants.
- Pilot new methods of individual researcher career assessment taking into account Open Science practices (applying FAIR Data principles, using open source, publishing in Open Access journals). This could be done, for example, for ERC Advanced Grants as researchers will have already consolidated their career and / or through the MSCA Individual Fellowships. Ideally, this could be done in parallel with existing career assessment process to compare and contrast the methods (EC).

[338] O'Carroll C., Rentier B., Cabello-Valdez C., Metcalfe J., Maes K., Vandevelde K., Halleux I.,Esposito F., Kaunisma E., McAllister D., Brach I., *"Recognition and Reward for Researchers engaging in Open Science"*, European Commission, July 2017 (doi: 10.2777/75255).

- Engage the researchers in the EC Expert Database (especially those with ERC and MSCA) to,
  - act as reviewers on the planned Open Publishing Platform;
  - to identify and publish in high quality Open Access journals;
  - to promote Open Access in their own discipline; and
  - to pressure journals where they are editors / peer reviewers to move to Open Access.
- There should be continuing flexibility with regard to the opening of research outputs and the exploitation of the same outputs by the researchers conducting the research to be able to profit from their own research and to further develop their careers (Universities).

Open Access to Publications

- Invest further at EU and national level in Open Science infrastructures such as EOSC (which will federate existing research data infrastructure and link existing Open/FAI datasets). This can underpin institutional changes within universities to foster transition towards more Open Science practices (EC, MS).
- Monitor usage of Open Access journals/platforms in Europe vs. global competitors – monitoring the evolution in use of open access journals/platforms could help to develop an improved understanding of the pace of progress and highlight outstanding gaps (EC, MS).
- Foster the development of research communities linked to Open Access journals and platforms (Universities).
- Reduce the costs of scientific publishing through transformative agreements with society/commercial publishers and investigating alternative publishing models and platforms. For example, investigate means to support society/small commercial publishers and Open Access platforms (especially no author-facing fee venues that are free to read/publish) (EC, MS, Universities).
- Promote a partnership-based approach with the larger scientific publishers that enables them to adapt their business models to the benefit of both universities and publishers (EC, MS). It is necessary to secure the buy-in of the larger players in some way as otherwise, there is a risk that entrenched practices will remain.
- Promote bibliodiversity, i.e. a diversity of publishing actors; a plurality of languages of communication, publication formats and funding methods, or a variety of levels of intervention (support for local initiatives stemming from communities) and perspectives, in a context of highly variable constraints and capacities for action (e.g. the divide between North/South countries)[339].

FAIR/Open Data

- Revising EU rules and conditions on ownership, access on sharing of data, methods and models including in Horizon Europe (EC, MS)
- Cooperation with Member States for management systems and platforms for FAIR and Open Data and knowledge-sharing (EOSC, EU R&I Data Hub)

[339] See Jussieu Call for Open Science and bibliodiversity -https://www.ouvrirlascience.fr/wp-content/uploads/2019/02/Jussieu-Call-for-Open-science-and-bibliodiversity.pdf.

- Ensure that universities have adequate data infrastructure capacities and services to technically cater for the storage, processing, sharing, and combining of FAIR and Open Data and that align with the future EOSC (EC, MS, Universities).
- Hire specialised data stewards working both across disciplines and in specific disciplines who can professionally support researchers in their data management and in making their data FAIR and Open (MS, Universities).
- Initiate a study to develop methods for recognising and rewarding researchers that make their data FAIR and Open. For example, if published Open Data source used in journal publication then authors must be added to list of authors (perhaps under a new category of Data Source) (EC, MS, Universities)
- There is also the question of licensing related to publications and data and code. For data, there is also a distinction between the metadata (must be CC0) and the data itself (almost never CC0 and not even necessarily openly licensed). A further distinction is between rules for research funded by public sources (more likely open) versus industry (more likely closed).
- There must therefore necessarily remain flexibility for businesses to financially exploit their own research outputs to encourage innovation and investment in collaborative research projects with universities.

Open Science Skills

- Provide funding and capacity-building support to enable universities to train researchers (R1-R4) in Open Science skills. It is critical that researchers at all levels, from PhD to Professor are supported in the practice of Open Science. In addition, research related staff should also have access to this skills training. This could take place both at the level of institutional coordinators, who could champion their universities' adoption of Open Science practices, and for individual researchers, where capacity needs to be developed (EC, MS, Universities)
- Teach the relevance of Open Science to Bachelors' and Masters' students; include teacher training with sabbaticals for research (Universities).

Strengthening the role of university libraries in the provision of open science services to researchers. [340]

Universities need to develop permanent teams to be able to provide open science services to their researchers and not only rely on external funding through research calls (e.g. EU funded through the FPs, national funding programmes). Libraries are in the process of developing such services, but these need to be supported with sustainable funding. Universities need to develop a holistic strategy on OS that includes funding provision to ensure adequate staffing. As there are growing teams dedicated to OS, open data and digitalisation in libraries within universities, this may be useful in helping universities to develop more effective OS implementation strategies over the longer term.

4.8 TM7: Optimising universities' role in research infrastructures.

4.8.1 Introduction

Excellent Research Infrastructures (RIs) are key to strengthening Europe's research and innovation capacity and universities play an essential role in this process, as they provide key scientific and technological output of RIs, often host and operate RIs and educate and train researchers, technicians and managers of RIs.

[340] The important role of university libraries regarding open science is highlighted later in this TM under Section 4.7.4 (see case study "Mandating (Green) Open Access at the University of Liège").

RIs include major scientific equipment or sets of instruments, knowledge-based resources such as collections, repositories, archives or scientific data, computing systems and communication networks and any other infrastructure for research, education and innovation of a unique nature. They may be single-sited, distributed, or virtual [341]. The EU has been supporting the development of a joint RI landscape over the past 20 years, assisted by the European Strategy Forum for Research Infrastructures (ESFRI)[342] which brings together representatives of governments and of the scientific communities to identify the scientific needs for new instruments and draw up a roadmap[343] for new and existing pan-European RIs.

An EU-level approach to RI policy and support was initially developed as part of the ERA in the early 2000s. The focus was on developing world-class research facilities and creating critical mass by pooling resources, thereby addressing the high costs and complexities of constructing large-scale RIs, whilst at the same time avoiding duplication and rationalising the efficient and effective use of RIs. This in turn led to the creation of ESFRI in 2002, tasked with supporting and coordinating the development of large-scale European research facilities which, some years later, was followed up with the publication of regular ESFRI roadmaps. These have led to a convergence in the planning and establishment of pan-European RIs, but they have also prompted Member States to develop national RI roadmaps which, as well as identifying scientific needs and gaps in individual countries and setting priorities for funding, have identified synergies with the ESFRI roadmaps. Later again came the ERIC Regulation (EC no. 723/2009), creating a legal form that facilitates the establishment and operation of RIs with European interest. Another important milestone for research infrastructures was the proposal to launch the European Open Science Cloud (EOSC) initiative, which will allow European researchers and professionals in science, technology, the humanities and social sciences to share a virtual environment with open and seamless services for storage, management, analysis and re-use of research data, across borders and scientific disciplines by federating existing scientific data infrastructures, currently dispersed across disciplines and the EU Member States.

Some of these pan-European RIs are being newly-built, whereas others are the result of upgrading or pooling existing resources at the national level (creating networks of national facilities operating like a single RI with complementary services and single-entry points). But most RIs in Europe are not on the ESFRI roadmap, and only interact sporadically with the facilities in ESFRI-connected networks. For the purposes of this study, they have been considered as 'national' RIs, and are funded by a variety of sources. While they are often situated/hosted within universities, they may also be located in and funded by government departments, public research institutes, industry, independent foundations and charitable organisations, all with their own regulations and procedures.

RIs are at the core of the knowledge triangle of research, education and innovation and play a vital role in the advancement and exploitation of scientific knowledge and technology. The role of universities, and especially research universities, is particularly crucial here. Even if an RI hosted on a university campus has a separate legal entity to the university and is, for instance, dependent on a public institute elsewhere, the university community contributes significantly to its daily operation and management with research facilities, researchers and management staff and related scientific and technical expertise. RIs therefore form a core element of research at universities at different levels, advancing science and technology, educating future scientists, co-developing with the private sector and other non-academic partners and reaching out internationally and to society at large.

See definition of research infrastructures as set out in the European Charter for Access to Research Infrastructures. https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf

[342] https://www.esfri.eu/about

[343] European Strategy Forum on Research Infrastructures (2018). [Online] [Accessed 15 May 2020]. Available at: http://roadmap2018.esfri.eu/media/1048/rm2018-part1-20.pdf

It will be increasingly important in future for the strengthening of European research and innovation efforts to enhance the opening up and sharing of resources and RIs to create critical mass and ensure scientific excellence. In the face of societal challenges such as the global spread of viruses, climate change, resources depletion and exponential growth of data, IRs are ever more relevant and the role of universities in contributing to their continued development and delivery is crucial.

In determining the role of universities in shaping the future excellence of RIs in Europe and beyond, it is important also to take account of **European/regional innovation ecosystems**. Effective R&I often takes place in a wider ecosystem, which may be local and place-based, or may be national or even international in scale. These typically feature a range of complementary interacting players, such as academia, research performing and technology organisations, industry, different levels of the public sector, not-for-profit organisations and civil society who share resources and work in partnership to create innovative solutions to challenges faced by society[344]. RIs are often one step ahead in co-creation with industry: the upgrade and design of new scientific instruments, for instance, needs the contribution of industrial partners with manufacturing capacity, and small innovation hubs within university campuses where industrial and academic profiles can work closely together. Their experience might be useful for universities trying to develop co-creative approaches with external partners, in order to take on a new central role in their regional innovation ecosystems.

The missions of universities to conduct research, to educate and train future academics and professionals, leaders and innovators and to drive disruptive innovations are increasingly carried out in networked processes of knowledge creation. The potential offered by connecting ecosystems across Europe with complementary resources and skills is being increasingly acknowledged and a specific 'European Innovation Ecosystems' component has been set up under Pillar III of Horizon Europe to provide support to building and strengthening such systems.[345]

Stakeholders comment that open ecosystems are one of the most important platforms through which universities can engage with non-academic partners, and transmit their knowledge, expertise and impact. The partnership model for cooperation between academic and non-academic partners promotes the sharing of equipment, facilities and expertise as well as promoting knowledge transfer and the relevance of education to working life as part of business collaboration.[346]

There are considerable interlinkages between the contribution of RIs to the development of 'European innovation ecosystems' and the issues discussed under TM5 'Co-operation with non-academic sectors' and some of the challenges raised in that section also apply here.

4.8.2 Challenges

In the wake of growing concern among Member States and RI stakeholders about the long-term sustainability (LTS) of Europe's RIs[347] the Commission was invited by the Competitiveness Council to develop an LTS Action Plan in cooperation with ESFRI and others. They therefore launched a consultation to collect stakeholder views on the main challenges faced by RIs and the potential actions to tackle the problems.[348] This process

[344] Carayannis, E.G. and Campbell, D.F. (2009). 'Mode 3'and'Quadruple Helix': toward a 21st century fractal innovation ecosystem. International journal of technology management, 46(3-4), 201-234.
[345] European University Association (EUA) (2019) 'The Role of Universities in Regional Innovation Ecosystems'
[346] Contribution by YERUN members
[347] Informal Competitiveness Council of July 2014 and Competitiveness Council of May 2016
[348] European Commission (2016) 'Report on the Consultation on Long-Term Sustainability of Research Infrastructures'.

subsequently led to a Commission Staff Working Document on the sustainability of RIs[349] and several ESFRI papers on the issue.[350] Various university associations have also contributed to the debate, providing their views on the role of universities in RIs. The challenges raised below reflect those identified as part of the consultation process. They also take into account the views put forward in relevant papers by LERU[351] and CESAER.[352]

Challenge 1: Maintaining and boosting scientific excellence

There is consensus that **'ensuring and boosting scientific excellence'** is the most important pre-condition for ensuring the LTS of European RIs.[353] This requires a collective effort of all involved actors at institutional, regional, national and European level. However, universities' role in this process is not always well-recognised. According to CESAER, the reason for this is that the transition has not yet been made from a linear vision of research and innovation to an ecosystem-based approach. In their 2019 White Paper, CESAER highlights the need for universities to be seen not only as users of RIs, but also as engines of excellence, talent and innovation that enable the functioning of RIs at all levels.[354] Indeed, universities have multiple and crucial roles in RIs, they not only host and operate research infrastructures, they also educate and train the necessary scientific, managerial, operational and support staff for RI and they are the employers of researchers as users, advisors and governors of RIs.

In short, universities provide the resources that allow RIs to function as enablers of excellent research and they contribute to the RIs' scientific, economic and societal impact. For scientific agendas to continue to be strong and sound they need to be drafted in accordance with academic freedom and institutional autonomy and CESAER therefore calls for universities to be closely involved in national policies and road mapping and decision-making processes relating to RIs.[355]

The role of universities is crucial in continuing to ensure the scientific excellence of RIs, but other drivers have also been raised as essential, including the continued investment in RIs throughout their entire lifecycle, professional management structures, and not least introducing transparent access policies for researchers and other users. These issues are dealt with below.

Challenge 2: Ensuring sustainable funding and effective governance

Notwithstanding the substantial construction costs, RIs are often extremely expensive to operate, maintain, upgrade and eventually terminate (e.g. decommissioning). As highlighted in the Commission's Staff Working Document on RI sustainability,[356] the development costs of some pan-European RIs can exceed €1bn with operational costs that amount to 10% of the construction costs each year. With an increasing number of pan-European RIs having now been implemented, these operational costs may need to be met from national science budgets which puts into question their LTS. Furthermore, differences in national budget cycles and the timing of updates of national roadmaps make joint investment decisions complicated. The processes governing the implementation of

[349] European Commission (2017) 'Sustainable European Research Infrastructures: A call for Action'. Commission Staff Working Document SWD (2017 323 final
[350] ESFRI Scripta Series (2017) Volume 2 'Long-Term Sustainability of Research Infrastructures' https://www.esfri.eu/sites/default/files/u4/ESFRI_SCRIPTA_TWO_PAGES_19102017_3.pdf
[351] League of European Research Universities (LERU) (2017) 'Four Golden Principles for Enhancing the Quality, Access and Impact of Research Infrastructures'
[352] Conference of European Schools for Advanced Engineering Education and Research (CESAER) (2019) 'Universities of Science &Technology As Engines Of Excellence, Talent and Innovation: Roles in Research and Innovation Infrastructure; White Paper
[353] EC 2016 Consultation (see above)
[354] CESAER (2019), Universities of Science &Technology As Engines Of Excellence, Talent and Innovation: Roles in Research and Innovation Infrastructure; White Paper. https://www.cesaer.org/content/5-operations/2019/20190313-white-paper-rii.pdf
[355] Idem. CESAER (2019)
[356] European Commission (2017) 'Sustainable European Research Infrastructures: A call for action'; Commission Staff Working document SWD(2017) 323 final

national roadmaps are often based on competitive calls, which do not take into account the long-term commitment needed for RIs beyond the lifetime of particular roadmaps. So, more needs to be done to coordinate the timing of ESFRI and national roadmaps to address this problem.

Moreover, the vast majority of RIs are not pan-European, but institutional, local and national facilities, many of which are highly dependent on universities. So even if national roadmaps have become better at coordinating and creating **coherence in the RI landscape and funding systems**, the fact of being included in national RI roadmaps does not necessarily guarantee funding, as funding decisions are taken at many different levels, whether nationally, regionally or institutionally. Another issue raised by LERU is that infrastructure grants tend to be geared toward initial construction and not to the operation of RIs.[357] Operational costs are generally covered through internal or short-term project funding that does not create the conditions needed for the sustainable operation of such RIs. Furthermore, researchers often cannot apply for basic equipment and materials, but basic funding at an institutional level is needed in order to maintain RIs. There are even examples of RIs that have been constructed, in some cases with ESIF, that are no longer being used as they cannot get sufficient support for operational costs. It is essential the investments made in RIs are being fully optimised subsequently allowing for long-term operation. These examples illustrate the importance of making long-term funding decisions at the initial planning phase, covering the whole RI lifecycle, including their operation, upgrade and termination. Given universities' diverse role as both hosts, funders and partners in many RIs, they are well placed to contribute to RI investment decision-making.

A mixed funding model for RIs is needed to provide adequate funding levels throughout the whole RI lifecycle, combining institutional, local, national and European resources. More funding options for national RIs as part of the next generation of EU funding instruments are needed. Otherwise, the provision of special support measures to boost universities' optimal use of EU funding programmes like Horizon and ESIF might also help. Given the emphasis on improving scientific excellence, CESAER suggests that additional funding would be especially important for RIs that promote multidisciplinary research, where diverse scientific domains meet as they often pave the way for excellent research and disruptive innovation.

Good, **professional governance** and management, equally based on a long-term vision, is another element needed to ensure the excellence and sustainability of RIs. Optimising the role of universities in managing and operating their own infrastructures efficiently and effectively would be an essential step in the right direction. In order to make efficient use of their RIs, some universities have already developed their own institutional roadmaps and institutional RI governance mechanisms, to help communicate what is available and provide user support.[358] Getting more universities to do the same or share good governance practices could be a useful way to help professionalise their management. It is also essential that university management is involved in funding decisions regarding the long-term operation and maintenance of RIs.

Stakeholders have also highlighted the **lack of availability of competent specialists** able to operate and maintain RIs as a major issue. These technicians are highly specialised and there are not many of them, so recruiting and retaining them is a challenge for some universities. Apart from providing special reward systems and career possibilities, specialist training schemes should be organised possibly even as part of national research and education systems.

There are also challenges to be resolved at a **political and legal** level. For RI policy to become long-term, solutions need to be found to contravene the constant changes in

[357] League of European Research Universities (LERU) (2017) 'Four Golden Principles for Enhancing the Quality, Access and Impact of Research Infrastructures'
[358] CESAER (2019), Universities of Science &Technology As Engines Of Excellence, Talent and Innovation: Roles in Research and Innovation Infrastructure; White Paper.

prioritisation that accompany political cycles. Another issue concerns the constraints that publicly funded universities might experience in relation to their management, for example legal barriers relating to the right to own, manage and operate RIs.

Challenge 3: Promoting transparent access to, and use of Research Infrastructures

The importance of providing access to RIs to improve their efficient use has been recognised by the Commission, among others through the European Charter for Access to Research Infrastructures,[359] and also through various RTD funding programmes. Wide access and offering high-quality services to users is also a key priority in the ERA. But although more and more universities define their access policies for RI usage in accordance with the Charter, a majority of users in all types of RIs are apparently still academic researchers and access is still limited.[360]

In practical terms, many RIs, especially the large-scale ones, tend to be oversubscribed and researchers find it difficult to gain access. However, finding alternatives can be challenging as there are no automatic links between RIs, so researchers are then forced to 'shop around' and apply for other structures. Since application templates, requirements and deadlines are not coordinated between RIs, this leads to a significant amount of additional work and wasted efforts. In contrast, other infrastructures are insufficiently used, in some cases due to a lack of funding for operational costs, as raised above, or because it turns out after completion of the RI that the user community was not sufficiently large. Identifying and getting access to RIs in other countries is also a challenge, but even at national/regional/local levels researchers sometimes struggle to get an overview of the RI landscape and what is available to them.

In order to address the currently imbalanced utilisation of RIs, LERU proposes greater transparency on access policies by providing online information that is findable, current, complete and controllable.[361] In a similar vein, CESAER advocates increased use of institutional roadmaps to improve efficiency in the use of RIs, by strengthening transparency and better communicating what is available and providing user support to both internal and external users. They also highlight that universities allowing RI access to, and cooperation with external non-academic partners is crucial to securing effective and open innovation ecosystems and has demonstrated enormous potential as drivers for disruptive, applied and incremental innovation. Generally, innovative and more effective means of coordinating and synchronising roadmaps and RI business plans should be found. This could be supported by the promotion of multidisciplinary cooperation between universities and with industry, the public sector and civil society, thereby also exploiting the innovation potential of RIs (see below, challenge 5).

Any future EU-funded initiatives to support universities in developing institutional roadmaps and in collating RI services already available across Europe should take into account the results of an ongoing contract, CatRis, which is in the process of putting together a catalogue of services for e-infrastructures in the EU.[362] The project recognises that the European RI landscape is diverse (RI operators, managers, users (researchers, industry) decision makers, funders). It also notes that previous efforts "were directed towards gaining insight into available RIs, national RI road mapping practices, and planning of pan-European RIs. Such information will improve the visibility of services, foster European and international collaborations, and enhance RI accessibility, usage, and impact". The project description also notes that currently, RIs provide information about

[359] European Commission (2016) European Charter for Access to Research Infrastructures: Principles and Guidelines for Access and Related Services. The Charter sets out non-regulatory principles and guidelines for defining access policies for RIs.
[360] CESAER (2019), Universities of Science &Technology As Engines Of Excellence, Talent and Innovation: Roles in Research and Innovation Infrastructure; White Paper.
[361] League of European Research Universities (LERU) (2017) 'Four Golden Principles for Enhancing the Quality, Access and Impact of Research Infrastructures'
[362] A Catalogue of Research Infrastructure Services, 1 January 2019 to 30 June 2021, coordinated by FONDATION EUROPEENNE DE LA SCIENCE, budget EUR 1.5 million https://cordis.europa.eu/project/id/824173

their services in free formats through websites with varying completeness and details. Arguably, there is a need to build on this initiative and to strengthen the cataloguing of access to physical infrastructures, which could be done if sufficient numbers of universities were to produce institutional roadmaps setting out how they will use the roadmaps.

In addition, it is also worth pointing out that there is some existing funding support through the Science with, and for Society (SWAFS) call within Horizon 2020 on topping-up funding for European Universities consortia, which aim to create university campuses spanning several EU Member States. Some applicants have sought to use this funding to map RIs hosted by partners in each consortium, and to agree on the modalities for the shared usage of such RIs. Some of the consortia go one step further, and refer to specific joint activities on RIs to serve their agreed common research priorities.

The organisation of a conference or a study to bring together the consortia taking part in the EUI to identify and analyse the lessons learned of these RI tasks in all 17 consortia could be envisaged.

Challenge 4: Adapting research data management at universities to the digital era

As stressed in the Charter, RIs and especially those operated in and around universities, play a central role in assisting Europe in the move towards open, interconnected, data-driven and computer-intensive research, education and learning.

Digital transformation is already having a significant impact on universities, but is likely to accelerate in future, not only in terms of universities harnessing the potential of new digital technologies in their way of operating and delivering research, education and learning, especially in direct response to the Covid-19 crisis, but digitalisation also raises a wealth of questions in relation to data management, data accessibility and security considerations, etc. There will also be a need to adapt research infrastructures to the new era and develop the necessary digital infrastructures.

The move towards Open Science and addressing societal issues through research brings complex challenges for individual RIs which will not only need to open up their data and services but also connect to other RIs to combine their data and services across disciplines for new discoveries. The European Open Science Cloud (EOSC) will federate existing infrastructures and create a web of interoperable data and services via FAIR and open protocols. Researchers will be able to find and exploit the data and services that are being offered by individual RIs and deploy services on FAIR data sets as well as gain access to local tools and instruments via the EOSC.

A key challenge for RIs will be to develop FAIR standards within their disciplines and promoting good research data management whilst becoming interoperable with FAIR data sets from other disciplines as well as to onboard and offer their thematic services within the EOSC ecosystem. These challenges will require adequate financial, technical, and policy support as well as buy-in by the research community in the short and long-term.

A study on the FAIRification from 2018 by Data Management Plan (DMPs) in ensuring that data is managed in a way compatible with the FAIR principles. The high-level group for the European Commission which wrote the study notes the important role that could be played by DMPs. "While they may seem an administrative burden at first, the process of creating - and updating - DMPs can provide important insights and lessons on how to gather, curate and disseminate data, building a common understanding across the project from an early stage and reducing administrative burdens over the project lifecycle". [363]

[363] Final Report and Action Plan from the European Commission Expert Group on FAIR Data, 2018 - https://ec.europa.eu/info/sites/info/files/turning_fair_into_reality_0.pdf

The same study notes that a further challenge is that "DMP requirements from funders and institutions are not harmonized, which is an issue for researchers and projects".

In this context, Artificial Intelligence (AI) can be seen as a supplementary 'scientific infrastructure for research and learning'.[364] Many universities already recognise that AI has many use cases in a university setting as a monitoring and research tool. However, universities will need to reflect on how AI can best be implemented to address their specific needs (see section 2.3 above).

Challenge 5: Unlocking the innovation potential of all Research Infrastructures

Universities have a clear role in maximising the use of their RIs as innovation hubs, which among other advantages helps to feed their scientific results into disruptive innovation. But this potential is often untapped as both RIs themselves and industry do not always perceive the benefits of collaboration and sharing of facilities.

In some universities, there may be a certain reluctance, often due to administrative and legal obstacles, to work closely with industry. Sharing access with SMEs and industry may require funding or other incentives (e.g. joint cooperation through ESIF-funded projects that foster public-private sector research projects that would not otherwise have materialised). They may also not have advanced particularly far in embracing a culture of allowing access more broadly, not only as regards sharing research results to accentuate their visibility and impact but extending access to RIs to external users may not be easy to do in some country contexts, where for instance there is a lack of tradition of university-business cooperation. Another obstacle for RI use by private sector researchers that has been mentioned is the lack of technicians on-site to assist them. Here again, additional funding might help solve the problem, but organisational changes would also be needed in parallel. The example presented earlier from Berne on translational research centres is a good example of a positive means of overcoming some of these problems, as it fosters a culture of sharing RIs and cooperation between sectors in a spirit of co-creation.

Stakeholders have also highlighted during the consultations for this study that the shared use of RIs by universities, research institutions and other partners, whether locally, nationally or internationally, is hindered by state aid rules that force universities to prepare detailed cost calculations for their use.

A further barrier to the sharing of universities' RIs is arguably the fact that the necessary digital infrastructure to put in place sharing arrangements may be under-developed. The development of e-infrastructures should be supported in parallel through efforts to open up physical infrastructures, for instance through the development of IT systems and electronic booking systems to plan and manage access to infrastructures for wider users for the mutual benefit of universities and the wider ecosystem. Sharing access could generate additional income, and when provided for free, it could foster strategic collaboration with other sectors.

Nonetheless, some RIs and universities have fully embraced the potential of working with multidisciplinary and multi-background teams in partnerships involving universities, other research organisations, industry, business, public services and society at large. These sorts of innovation eco-systems create an environment where interaction is spontaneous and promote the sharing of expertise in the spirit of open science. They facilitate the creation of something new together from the very beginning of the research. This sort of cooperation has demonstrated enormous potential as drivers for disruptive, applied and incremental innovation.[365]

[364] https://www.weforum.org/agenda/2017/08/artificial-intelligence-will-transform-universities-here-s-how/
[365] CESAER (2019), Universities of Science &Technology As Engines Of Excellence, Talent and Innovation: Roles in Research and Innovation Infrastructure; White Paper.

In such collaborative partnerships and value-chains, RIs become enablers of technological, social and economic development and competitiveness.

4.8.3 Transformation needs

By 2030, there is a need for the roles of universities in RIs to be well recognised in the national and European contexts. As drivers of scientific excellence and creators of talent and innovation, universities will play their full part in contributing to key EU policy objectives for RIs, such as:

- reducing fragmentation of the overall research and innovation ecosystem through collaboration and sharing access, where appropriate;
- enhancing the effectiveness and efficiency of RIs and better coordinating their development and use;
- encouraging a long-term vision in how RIs are planned and in the way they are governed and managed to ensure RI excellence and sustainability;
- joining forces internationally to construct and run large, complex expensive RIs;
- stimulating the innovation potential of RIs by enhancing collaboration with non-academic partners;
- embedding university RIs in local, regional, national, European and global R&I ecosystems in industrial value chains; and
- developing and operating local data infrastructure capacities and services, in full alignment with FAIR data principles, good research data management and with the future federated EOSC to create a web of interoperable data sets.

4.9 Case studies and success stories

In response to the invitation to stakeholders to propose success stories, some of the examples suggested in relation to Research Infrastructures are set out here:

New Strategy for Chalmers research infrastructures - Sweden

Objectives: Given a dramatic change in recent years in Sweden in the opportunities for receiving external funding for RIs and equipment, with focus having shifted to larger RIs with a clear national interest, Chalmers University of Technology felt that they needed to take more responsibility for risk-taking and governance of their RIs at the central university level.

Description: They have therefore developed a strategic planning for RIs which will also contain a Chalmers RI roadmap to be revised annually. The strategy document, *Chalmers Research Infrastructures*, describes what the university wants to achieve and how to get there. It provides guiding principles for establishment, continuous up-grading, evaluation and decommissioning and sets out the criteria that must be satisfied for a laboratory or installation to be deemed Chalmers research infrastructure – and thus be eligible for potential support from the president. One requirement for eligibility for central funds is that the installation must be available to all researchers on equal terms. It must also be entirely or partially owned and controlled by Chalmers and have a broad user base. Ten laboratories and installations are currently considered as Chalmers University facilities, and more are being added. A funding plan is needed to satisfy the admission requirements. Even though the different RIs will typically have their basis in research, it should also be possible to use the equipment for education purposes and collaboration with other parties.

Key achievements / lessons learned: The fact of owning and controlling their own research infrastructures, Chalmers University is able to offer a wide array of state-of-the art research facilities, made available to all researcher on an equal footing allowing them to conduct outstanding research.

New Strategy for Chalmers research infrastructures - Sweden

Replicability / transferability potential: Provided that appropriate funding sources are available, this type of strategy to place responsibility for RIs at the central university level could be set up in many universities across Europe

Sources of further information:
https://www.chalmers.se/en/researchinfrastructure/Pages/default.aspx
https://www.chalmers.se/en/news/Pages/New-strategy-for-Chalmers-research-infrastructure.aspx

Contact: Prof. Alf-Erik Almstedt, responsible for research and doctoral programmes at Chalmers University / affe@chalmers.se/+46-317721407

AI Hub Tampere – Finland

Objectives: The project aims to provide consultancy to local SMEs in the application of artificial intelligence in business development. It is described as a 'rendez-vous' between university specialists and SMEs in the region and beyond.

Description: AI Hub Tampere is a new artificial intelligence research centre hosted and governed by Tampere University and funded by public instruments (ERDF, Council of Tampere Region). The centre organises workshops, helpdesk sessions, experimental piloting and other support for adopting artificial intelligence in local companies. The objective is to make AI easy to reach, affordable and all the centre's services are free of charge, neutral and equal for all. The centre is part of a nationwide network of AI centres that is currently being built.

Key achievements/lessons learned: The AI Hub is a new project so there are no lessons learned as of yet. In terms of achievements, the Hub carries out experiment pilot projects during which specialists are able to tackle a particular technical problem/challenge within 5 days through tests, trials and machine learning methods.

Replicability/transferability potential: Provided that appropriate funding sources and scientists with AI expertise are available, this type of AI research centre could be set up in many places across Europe.

Sources of further information: https://tampere.ai/en/

Contact: Minna Kinnunen / minna.kinnunen@businesstampere.com / +358-405899700

The next example focuses on a cross-disciplinary co-operative initiative which involves networking across an innovation ecosystem, with the open aspects of the ecosystem providing access to different research actors and users of the university's small infrastructures.

Open Kuopio Health Innovation Ecosystem – University of Eastern Finland

Objectives: The overall goal of Kuopio Health cross-disciplinary co-operative is to provide an easier access to the core of innovation work and to enable globally effective research, development, innovation and training operations in flexible cooperation with businesses, educational institutions and other public organisations.

Description: Kuopio Health is an open ecosystem and a network which combines world-class top expertise in the areas of health, well-being and nutrition. The basic principle of its operations is to ensure and promote the free movement of open information, open data and open innovations to increase and commercialise Finnish know-how. Kuopio Health promotes development, research and new innovations based on customer needs and acts as a platform for new products and services. It conforms to an open innovation model in combining the public sector, academia, industry and end-users enabling the creation of new solutions and networks.

Open Kuopio Health Innovation Ecosystem – University of Eastern Finland
Key achievements/lessons learned: Kuopio's global leadership in health and life sciences is driving innovation in specialist areas such as Metabolic, Heart, Cardiovascular, and Neurological diseases, including Alzheimer's and Parkinson's. The ecosystem benefits greatly from Big Data sources via the region's university hospital's data lakes and through secondary use of health data through Sensors, Robotics, and Internet of Things. Due to robust research and knowhow, Kuopio is considered a part of the main Health Science hub in Finland.
Replicability/transferability potential: Kuopio Health is fast becoming one of the world's leading open innovation ecosystems, so it might not be that simple to replicate.
Sources of further information: (https://kuopiohealth.fi/en/) / Contact: CEO Aki Gröhn, +358 50 403 7540, aki.grohn@kuopiohealth.fi / https://www.businesskuopio.fi/en/investinkuopio-en/health/

4.9.1 Possible actions

EU level

The **European Charter for Access to Research Infrastructures** should be updated and its implementation improved and assured at institutional level, including sharing of best practice on the management and operation of infrastructures at universities.

Funding: Funding for, and access to state-of-the-art technology and RIs in the ERA is crucial. Identifying a mechanism that helps to fund the maintenance of RIs would be essential to avoid previous EU investments in such RIs being wasted (for instance providing more money to the IPCEI instrument[366] in order to allow Member States to come up with new ideas for infrastructure investment. This should be completed with a training scheme for 'maintainers' (see below). Special actions are also needed to guide universities to effectively use EU funding from Horizon and ESIF for their infrastructures.

Policy instruments: EU programmes and policies may be able to address some of the challenges by providing strategies and tools to support infrastructures. Horizon Europe, in particular, with its new approach to widening, cohesion and building synergies, and an emphasis on smart specialisation strategies, will be essential in creating the basis for a more coordinated network of RIs. Especially the component in Pillar III on 'European innovation ecosystems', will be instrumental in providing support to innovation ecosystems and through those to university-based infrastructures.

Given the difficulties that researchers face in terms of getting access to oversubscribed RIs and having to try to find alternatives, there should be greater transparency on access policies and available access units through online information that is findable, current, complete and controllable.[367] Although the MERIL database does provide a list of the RIs identified by Member States, there is currently no register of RI access policies and availability. Setting up such a register could significantly reduce the transaction costs of researchers having to use a 'trial and error' approach to identify available RIs. The EU could also encourage universities to increase their use of institutional roadmaps to improve efficient use of RIs. During the consultations for this study, some stakeholders suggested to improve the overview of existing RIs and coordinate their use by setting up an overall pan-European coordination system, modelled on a 'booking.com' or 'Airbnb' type approach for research infrastructures.

[366] Important Projects of Common European Interest. https://www.clustercollaboration.eu/tags/ipcei
[367] League of European Research Universities (LERU) (2017) 'Four Golden Principles for Enhancing the Quality, Access and Impact of Research Infrastructures'

To alleviate the lack of competent people who are able to operate and maintain RIs, a scheme to train such specialists should be considered, for example under the ITNs (Innovative Training Networks) of the MSCA. An EU-level Sectoral Qualifications Framework (SQF) for RI staff might also help to build capacity and – more importantly – to boost the intersectoral mobility of RI staff to and from their academic and non-academic partners.

Feedback from stakeholders indicate that whilst the Commission has strong insights into (large-scale) pan-European RIs, they have less attention for and knowledge of (smaller-scale) institutional, regional and national infrastructures, including those of many universities, and in particular, as to how national infrastructures work and are organised. It is crucial to improve the mapping and understanding of such RIs to identify their needs and to unlock their potential providing access more users, including SMEs in regional innovation ecosystems[368] and to better interconnect them with the large facilities. A link can be made here with the opportunities to strengthen transnational and/ or cross-border collaboration between universities, i.e. through the creation of common infrastructures at a regional level across borders.

Soft interventions: Enhanced use of tools like sharing best practice and mutual learning will also be useful in bringing about the required changes, especially if they happen at the instigation of the EU on a pan-European scale rather than on a more national or voluntary basis. In general, more should be done to acknowledge the role of universities in ensuring the scientific excellence of RIs and promoting professionalised management of RI and excellence-based access.

National level

- A key transformation need at Member State (and university level) will be to fund, develop and operate local data infrastructure capacities and services, in full alignment with the FAIR data principles.
- An inventory should be carried out of national legislation prohibiting universities to own, manage and operate infrastructures and any legal barriers should be removed.
- There may be a need for transforming policy frameworks for RIs at national level and for closer involvement of universities in the development of such frameworks. The aim would be to ensure stable framework conditions for the governance and funding of RIs in the ERA.
- In addition to the pan-European RI coordination instrument proposed above, more should be done at national level to engage relevant stakeholders when developing (national) RI roadmaps, not only to improve awareness but also to ensure a higher degree of completeness. Efforts to coordinate national RIs in terms of application procedures and deadlines would also be helpful.
- To ensure alignment with European roadmap cycles, Member States and associated countries should proactively determine their national RI roadmaps prior to an ESFRI roadmap update allowing for the effective and efficient collection of political support and financial commitment. It is important that national RI roadmaps contain shortlists of RI, which realistically will be funded. Countries should engage all relevant stakeholders within their science systems - including universities and regional authorities - when developing their national RI roadmaps.
- In order for RIS to take on the challenges of the digital transformation, they will require adequate financial, technical, and policy support as well as buy-in by the research community in the short and long term.

[368] Already a component of SMART specialisation strategies.

Universities

- Universities are encouraged to design and adopt institutional infrastructure roadmaps and to professionalise their management and operation of their infrastructures (including local data infrastructures to support Open Science and FAIR data) through the sharing of best practices.
- A priority at the university level will be adapting research data management at universities in a way that is fit for the digital era. Universities should develop local data infrastructure capacities and operate related services. In parallel, they should implement good research data management principles in line with FAIRification principles. Greater standardisation and interoperability of datasets across the FAIR data ecosystem needs to be promoted. Universities have their role to play in this regard, alongside researcher funders at EU and national levels. Universities will need to ensure that their data management approaches includes alignment with the future federated EOSC to create a web of interoperable data sets. [369]
- Universities should encourage researchers undertaking research projects that produce or collect research data must to specify their approach to data management during the project and in the delivery of key scientific objectives. This could be set out in a Data Management Plan (DMPs).
- Universities should apply and promote the European Charter for Access to RIs[370], adhere to the FAIR principles and apply good research data management. Universities managing and operating infrastructures should define and communicate clear access policies and declare available access units.
- Universities should acknowledge the involvement of their staff in RIs in their recruitment, career development and rewarding policies and promote the intersectoral mobility of staff from and to RIs.
- Universities should align their infrastructure cycles with the ones at national, European and global levels and participate more in RIs actions under Horizon.

Those universities with a weak tradition of working with external partners or in allowing industry and SMEs to access facilities should attempt to bring about cultural change within their institutions in order to build new partnerships with non-academic partners.[371]

[369] Final Report and Action Plan from the European Commission Expert Group on FAIR Data, 2018 - https://ec.europa.eu/info/sites/info/files/turning_fair_into_reality_0.pdf
[370] European Charter for RIs - https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf
[371] In some cases this might involve a change of the rules for the use of infrastructures which could be dependent on national frameworks or funds, which are not within the complete control of universities.

5. Towards the implementation of the 2030 Vision for research and innovation

5.1 Overview

The successful implementation of this initiative will require the buy-in of universities and their representative associations, including the university networks at a European level. It will also require engagement and commitment from relevant actors and stakeholders at all levels of governance - EU, national, regional and local. However, it is important to stress that the autonomy of universities in this regard is paramount. There are a large number of recommendations and actions for each of the transformation modules. The approach presented in this section seeks to provide a bottom up approach that facilitates universities to identify their own priorities within the wide range of actions for the various transformation modules. It should also be emphasised that universities are not expected to implement all of the recommendations; this will depend on their own particular circumstances and priorities. Diversity in institutional strategies can be beneficial and some universities might concentrate more on some priorities of a module than on others. The implementation method should allow for the creation of framework conditions to connect the excellent research available in universities, transdisciplinary and transnationally. It is not about further concentration of excellence in specific institutions only but should enable strong inter university connectivity. A methodology for enabling universities to identify their own objectives in relation to the transformation modules is elaborated in section 5.4 below.

The 2030 Vision should provide a framework to strengthen universities in Europe, based on the existing principles of research and scientific excellence, which is fundamental to the achievement of a successful knowledge society in the context of the revitalised ERA Communication in 2020. However, there is a challenge in transforming the university sector as a whole in Europe by lifting more universities to a higher research excellence level. In a widening participation context, this demands that universities in some regions need greater support in specific TMs, as they have greater transformations to make compared with leading universities, who may already demonstrate many of the good practices identified in this report, although they may still need to make further transformations in particular modules based on their own priorities.

This requires not only a supportive policy and regulatory framework at EU level and national level, but also for universities themselves to set their own R&D&I objectives autonomously in the context of the revitalised ERA framework. Universities would benefit in particular by developing action plans to set out their R&I goals and specifically to align their bottom-up, curiosity-driven research with evolving R&I priorities set at EU level in relation to the societal challenges and in particular the SDGs, which are of strong interest to universities. It would therefore be mutually beneficial for universities to review how the right balance between curiosity-driven research and addressing the societal challenges could be struck in their research activities, and by maximising synergies between the two. For instance, universities could strengthen communication of the results and impacts of curiosity-driven research so that the short-term utility of these to address societal outcomes and the SDGs is better communicated to society whilst retaining a focus on the longer-term strategic impact of such research, which will remain important.

The vision needs to be supported by different means to achieve its implementation. This will need to consist of:

- EU level support for universities to play their role in implementing the vision for research and innovation for universities in Europe by 2030. Such support will necessarily need to recognise that universities are part of a diverse landscape and different transformation modules will have differing degrees of relevance to particular universities.

- Recommendations addressed to national (and regional in some cases) authorities regarding how they might best support the vision and its detailed implementation by universities, for example by taking steps to improve the framework conditions in which universities operate, helping to overcome any national regulatory obstacles to cooperation between universities, researcher mobility, reform of career appraisal systems, etc.
- A detailed description of what embracing the different transformation modules might mean at the level of individual universities. For instance:
  - If good implementation practices are identified to support each module, universities could compare where they are currently in terms of the baseline situation and what steps they need to take to raise their game to the level of the best in Europe.
  - An analysis of the costs of undertaking activities mentioned in the context of each TM, drawing on the findings from the cost-benefit assessment to be undertaken in March/April 2020 by the study team.

5.2 EU level support for the vision's implementation

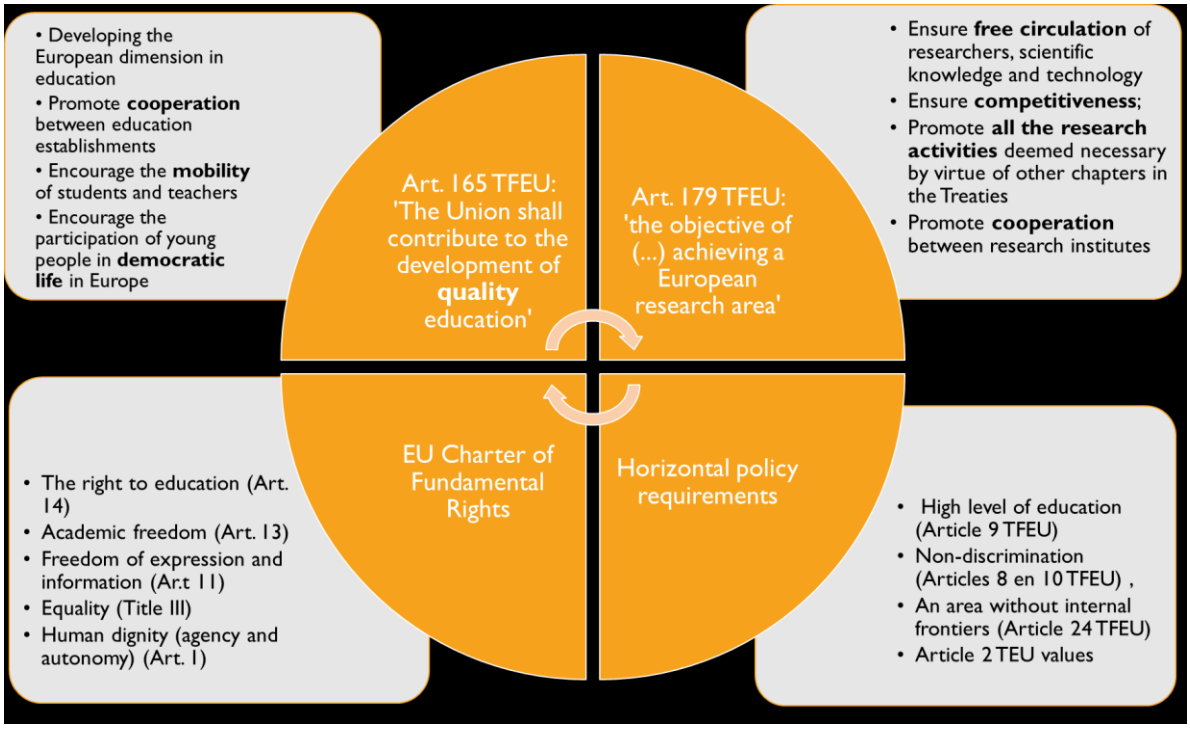
At EU level, a combination of the following types of support and tools will be necessary;

- Legal provisions, such as under Article 185(5) TFEU or relating to the "Innovation Principle";
- Policy frameworks, such as ERA Roadmap, European Semester or the Policy Support Facility;
- Funding, such as from Horizon Europe, Erasmus+, European Structural and Investment Funds and others, as appropriate;
- Policy tools and soft power instruments, such as charters and codes of conduct or instruments under the open method of co-ordination.

Law and regulation when used wisely can be a highly effective tool to implement change. The figure below summarises four key areas and the relevant legislation (Garben 2020). For example, in the case of attracting international researchers to Europe, the Third Country Researchers Directive (2005) or scientific visa requires Member States to provide a mechanism to admit nationals from outside the European Economic Area (non-EEA) for the purposes of scientific research.[372]

[372] European Council Directive, (2005). Directive 2005/71/EC *On a specific procedure for admitting third-country nationals for the purposes of scientific research* (OJ L 289, 3.11.2005). Brussels: Official Journal of the European Union. Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:289:0015:0022:EN:PDF

Figure 5-1: EU legal provisions relevant to the transformation of universities



Source: Professor Dr Sacha Garben

Another aspect that will be necessary will be reforms of ERA Roadmaps. In the future, Member States will need to incorporate universities explicitly into their national roadmap. This means that they will need to identify the measures that they will take to support their universities in achieving the 2030 Vision. The Policy Support Facility could provide best practice, independent high-level expertise and guidance to Member States in how to achieve this with its services including peer reviews, mutual learning exercises and specific support to countries.

While different EU funding programmes are available to universities, they must be accessed separately, which risks creating funding silos that have to be co-ordinated within universities. In order to achieve the 2030 Vision, there may be a need to review how funding programmes can be better designed and/or managed in such a way that individual universities or groups of universities can access and co-ordinate funding from different programmes for a package of measures. For example, upstream simplification as well as simplification for the beneficiary via acceptance of usual accounting practices.

Finally, there are a range of possibilities for policy tools that can support the implementation of the vision using "soft power" instruments. The strength of these tools lies in their non-coercive nature, with universities and other stakeholders engaging with them on a voluntary basis. For example, implementing the European Researchers Charter and Code of Conduct for their Recruitment (2005) is voluntary.[373] At the same time, these tools can be influencing in bringing about positive change when they are integrated into the requirements for receiving EU grant funding. The Marie Skłodowska-Curie Actions (MSCA) have contributed to the systematic implementation of the Charter and the Code of Conduct by setting standards for quality (doctoral) training, attractive employment conditions and open recruitment for all EU researchers.

[373] European Commission. (n.d.). *The European Charter & Code for Researchers*. [Online]. [Accessed 15 May 2020]. Available at: https://euraxess.ec.europa.eu/euraxess/charter-code-researchers

5.3 National support for the vision's implementation

The vision needs to secure the support of national policy makers, research funders and relevant national authorities responsible for research and innovation policies, as well as education. The buy-in of national actors will be crucial in being able to implement as ambitious strategy as possible. Therefore, securing national support will be crucial in many different ways, for instance because:

- National policy makers set national policies on universities in relevant areas such as the degree of autonomy of universities and research and academic career evaluation and assessment system. As such, they determine the framework conditions (including legal framework) in which universities operate;
- National policy makers and authorities also have strong political influence domestically and could serve as champions for implementation of the vision for the future of universities, for instance by lobbying to eliminate outstanding regulatory obstacles to greater pan-European cooperation in R&D&I; and
- National funding agencies in the fields of R&D&I provide over 90% of aggregated recurrent research funding across Europe. However, even at about 5% of the total, EU funding plays a critical role in providing transnational collaborative research funding, an in setting global standards of scientific excellence through the ERC and further supporting research career development with the MSCA Actions.
- This is reflected in the high demand for EU funding, but this has led to low success rates. Member States are committed to implementing the ERA, but this needs to be better reflected in terms of how research is funded nationally. This underlines the need for national funders to streamline their research funding, for example, by aligning their funding priorities with the strategic agenda for research and innovation provided by the EU, and to address key priorities relating to the global societal challenges and the SDGs.[374]

5.4 Implementation tools for universities

A critical part of the Vision will be its implementation and how this can be achieved taking into account the diversity of university systems across European countries. As stated above it is not the intention that each university must achieve all the recommendations in the transformation modules. This can be based on their own strategic priorities and in any case, it will be their autonomous decision.

The implementation tool will take into account the diverse goals of universities with different traditions. For example, some but not all will want to intensify their collaboration with industry. Also, universities in different countries will have very different requirements. For example, working conditions for researchers across Europe vary widely. In some cases, recruitment is fully open whereas in others there are national restrictions that hinder universities in their ability to hire the best candidates. This means that a one size fits all approach will simply not work. One needs a method that can be adapted to the needs and abilities of individual universities.

The following example from ERA policy demonstrates a proven method that could be the basis for universities to implement the 2030 Vision.

[374] EUA. (2020). *Building synergies between education, research and innovation by aligning the EU funding programmes.* Available at: https://eua.eu/resources/publications/918:building-synergies-between-education,-research-and-innovation-by-aligning-the-eu-funding-programmes.html

Box 5-1 - Example of implementation tools – the role of charters and codes

The 2005 European Charter for Researchers and Code of Conduct for their Recruitment (Charter and Code) includes 40 principles setting out the rights and responsibilities of researchers and employers.[375] This covers a wide range of researcher related areas including recruitment, professional development and career assessment. This was of course developed in the context of ERA. The Charter and Code is voluntary for universities in Europe, but it is now also embedded on a mandatory basis for successful research grant projects in the Horizon 2020 Model Contract (Art. 32, 2019).[376]

While over 1228 universities have signed up to the Charter and Code, the challenge has been in encouraging its wider adoption and implementation. A number of attempts were made to introduce a standard (similar to ISO9000) to show that an institution adhered to the Charter and Code. However, it was quickly recognised that the diversity of universities and different stages of development coupled with national legislation would have made this impossible.

The solution was the HRS4R Excellence in Research Award.[377] The initiative was based on self-assessment through a Gap Analysis that compares an institution's practices with the 40 Principles. This then leads to a comprehensive overview of institutional practice and how close it is to respecting and implementing the Principles. The institution then prepares an Action Plan that identifies which of the Principles where there is a gap will be prioritised. The scheme recognises that universities may simply not have the financial resources or the fact that there are national regulations that prevent them from implementing one or more of the Principles. However, the Action Plan allows them to identify where changes can be made and set a timeline for implementation. This is then reviewed by the Commission supported by peer review and if successful the university receives the HR Award. The value in this approach is that it takes fully into account the diversity of universities and the level to which they can take unilateral action to move closer to implementing fully the Charter and Code.

This process could be adapted for implementing universities' ambitions in the context of the European Research Area (ERA) and the 2030 Vision.

This method used for the European Charter for Researchers and Code of Conduct for their Recruitment could be adapted as a means for universities to develop their own objectives for implementing a subset of the transformation modules recommendations. A gap analysis could be carried out under the thematic and cross-cutting transformation modules identified in Section 4 using the following questions for each transformation module:

- What needs do universities have in this process? Which institutional changes do they need to accomplish?
- What are the crucial challenges that changing societies are facing at different levels relevant to universities (European, national, regional and local)? How can universities address them?
- Which solutions can universities offer to these challenges? What is their role?
- At which level will these changes need to be tackled and what kind of support is needed: university level – Member State level – EU level?

The three key aspects to be identified will be those of regulation, reform and resources. Regulation could mean that changes in national or European legislation or the introduction of new (or reform of exiting) charters is necessary to implement aspects of transformation modules. Reform would use the tools of ERA Roadmaps and Mutual Learning exercises to align national objectives with the Vision and share good practice between universities.

[375] European Commission. (n.d.). *The European Charter & Code for Researchers*. [Online]. [Accessed 15 May 2020]. Available at: https://euraxess.ec.europa.eu/jobs/charter
[376] European Commission. (2020). *H2020 Programme AGA – Annotated Model Grant Agreement*. https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf
[377] European Commission (n.d.) *Human Resources Strategy for Researchers*. [Online]. [Accessed 15 May 2020]. Available at: https://euraxess.ec.europa.eu/jobs/hrs4r

Resources will open the various European funding streams for universities to implement their prioritised transformation module recommendations.

Performing a gap analysis on TM4 Human Capital would show explicitly where universities would not be in a position to achieve aspects of this TM recommendations due to circumstances outside of their control, e.g. national employment legislation. This would then highlight to Member State governments (especially legislators and research funders) where they would need to intervene to support their universities in achieving the Vision. The possibility of the introduction of European regulations in the field of research and innovation would be a means to lift universities out of national constraints. This would not impinge on the principle of subsidiarity as it would simply highlight the issues around the Vision for a Member State to intervene. It would also provide universities with a tool to identify the areas where they could take action and those where there are obstacles.

As pointed out above, in terms of actions, there is a need for different organisations and institutions to work together and be involved at different levels of governance, from individual universities to the university networks and EU and national associations organisations representing the interests of universities at a European level. Therefore, in order to achieve real impact a comprehensive support mechanism must be put in place that is available to a range of organisations from single universities, to representative bodies for universities across Europe. Simply replicating a standard funding approach will not be sufficient as a large number of piecemeal projects will not achieve any vision. This is shown in Table 5-1 where the different levels with associated actions, types of actions and some examples area given.

Table 5-1 Examples of support actions and implementation methods at different levels

Level	Action	Types of Applicants	Example of Methods
Local	Res	Individual Universities	Providing peer review of university Action Plans for Vision 2030 with advice on how to implement.
Regional	Res, Ref	Regional Groups of Universities	Ensure that such organisations are involved in EU-level discussions about the implementation of the Vision 2030, alongside EU level networks / associations.
National	Res, Ref, Reg	National University Representative Associations (Rectors Conference…)	Ensure that such organisations are involved in EU-level discussions about the implementation of the Vision 2030, alongside EU level networks / associations.
Transnational	Res, Ref	Cross border Collaborations	Initiate a study to develop methods for recognising and rewarding researchers that publish Open Data. For example, if published Open Data source used in journal publication then authors must be added to list of authors (perhaps under a new category of Data Source)
European	Res, Ref, Reg	Representative Associations of universities in Europe (the EUA,	Initiate a study to assess the viability of introducing a Directive for new Codes of Conduct (Gender,

Level	Action	Types of Applicants	Example of Methods
		LERU, CESAER, the GUILD, the Coimbra Group, YERUN…)	Open Science, Research Integrity and Citizen Science)
Global	Res, Ref, Reg	Non-EU universities and university associations. Other societal actors.	Use access to RTD Framework Programme funding and Trade Agreements to leverage global reciprocity in Open Science and Research Integrity.

Res = Resources (funding including Horizon Europe, ERASMUS, Structural Funds etc.)
Ref = Reforms (Policy Support Facility, European Semester, ERA Roadmaps etc.)
Reg = Regulations (Directives, Codes of Practice, Charters etc.)

In order to enable this process to be really effective and for universities to be able to instigate change, consideration should be given as to whether a more integrated approach could be adopted at EU level to structuring European funding, such that universities could access combined funding sources. There are however legal constraints presently in this regard.

When using the current mechanisms, this would mean that universities would have to seek funding from different programmes that operate independently with separate deadlines and terms and conditions. Some EU funding is distributed directly by the Commission (H2020) and others through Member States (Structural Funds). Ideally, there should be greater integration of different EU funding streams for universities, for example combining funding from the Framework Programmes, ERASMUS+ and ESIFs in order to maximise research impacts and to optimise synergies through the use of different EU (and even national and EU) funding instruments. Whilst there are currently legal challenges and programme planning constraints in combining funding sources easily in the next MFF (as indeed in previous MFFs), this is a challenge for the Commission and the Member States to find appropriate solutions. There should also be the option of Member States, regions and universities themselves to provide co-funding to help boost the overall available resources to achieve the necessary transformations.

6. Summary of key issues and Strategic Recommendations

6.1 Strengthening the contribution of universities to the ERA in the next decade

In the previous decade, extensive policy and programming actions have been taken through the European Research Area (ERA) to strengthen research and innovation. During this time, universities across Europe have played a central role as anchors in innovation ecosystems at local, regional, national and European levels in contributing to the previous ERA priorities, such as optimising transnational cooperation (including research infrastructures) and competition as a driver of knowledge generation underpinned by excellent research; an open labour market for researchers; and fostering international cooperation. In pursuing the ERA priorities, there has also been an increased stress on ensuring cooperation with education, in the context of the European Higher Education Area (EHEA).

The revitalised 2020 ERA Communication is expected to provide a renewed impetus to strengthen and reinforce the ERA. This implies strengthening cooperation between relevant stakeholders, ranging from EU-level policy makers, through to research actors, particularly research-performing organisations at national, regional and local level. As drivers and agents of change in the R&I, education and broader societal fields, universities will continue to have a central role in supporting ERA implementation through their core missions.

As regards cooperation and engagement with other sectors, universities already cooperate extensively, but will need to do so with an increasingly diverse range of actors, such as industry/business, government/public sector and societal actors, including the non-profit sector, to align universities with the quintuple helix model. This implies that more universities could adopt a more holistic, institutionally-embedded and structured approach to fostering cooperation with other sectors than in the past, to encourage knowledge transfer and dissemination in a way that increased awareness and understanding among society and citizens about the impacts of universities' research through curiosity-driven and top-down research programmes (especially those linked to societal challenges).

The way in which universities contribute to the new ERA priorities will clearly need to consider future changes to the research and innovation landscape, as well as fast-changing societal and technological changes, which impact on the operating environment for universities across Europe.

Between now and 2030, major challenges lie ahead for the university sector, strengthening societal engagement and enhancing trust in universities; responding to technological developments, such as digitalisation and digital transformation, and fostering open science and open access to data whilst protecting research where necessary (in case of a lack of reciprocity internationally and/or foreign interference). Appropriate use of Artificial Intelligence and other digital technologies clearly has an important horizontal role in strengthening the implementation of most of the modules, and it is important that this goes beyond strengthening digital skills alone, given the major implications of technology across all aspects of the university R&I mission (e.g. open science, communicating research results, better measuring research impacts, streamlining data collection and analysis during research projects, and harnessing the potential of big data to accelerate particular aspects of the research process and to deliver more accurate research results).

The societal context in which universities operate is changing due to major global paradigms such as globalisation (and counter-reactions such as anti-globalisation and nationalist movements), an ageing society, increased diversity, the attendant need for greater social inclusion, and the increased importance of major societal challenges, especially climate change, environmental issues and sustainability. The increased pace of societal challenges is likely to impact on universities in the short, intermediate and longer-

term. However, the urgency of addressing societal challenges, such as those highlighted in the SDGs reinforces the need for universities to consider EU-level strategic priorities in this field in determining their research agendas. In doing so, they must also retain their autonomy and academic freedom to pursue the research agendas most appropriate to the identified needs of society – including the local, regional, national, European and global dimensions.

Universities have also stressed that in the next decade, their independence and autonomy institutionally – and the academic freedom of individual researchers and academics – needs to be reaffirmed at EU level and across all the Member States to enable them to make their full contribution to their own R&I policy priorities, which in turn are likely to contribute to EU-level strategic priorities, such as those linked to the SDGs. Addressing such complex challenges as the SDGs will require universities in Europe to adopt a combination of disciplinary and inter-disciplinary approaches. The latter will demand increased attention by universities compared with the period 2000-2020, to ensure that interdisciplinarity can be better recognised and rewarded in career development and appraisal systems, and that it is also reflected institutionally within recruitment systems.

In order to maximise universities' contribution to addressing major societal challenges, to contribute to economic growth and quality jobs, and to derive improved value for money for Member States and citizens who ultimately fund EU R&I, the role of open science, open access and open data are likely to be increasingly important. However, here, universities have to remain alert to the need for reciprocity from partners in third countries and the risk of foreign interference, which has been recognised at EU level as a growing problem.

Whilst the needs and strategic challenges faced by universities in the next decade are numerous and complex, there are also many opportunities for them in the research and innovation field. The 2030 Vision and the transformation modules set out above contain many suggested actions that could help universities to take advantage of the many available opportunities, whilst also addressing the challenges.

6.2 Strategic recommendations

The 2030 Vision and transformation modules in the main report contain a longlist of different suggested actions that could be implemented at three different levels (1) EU level (2) national level in the Member States and (3) university level. As the Vision will be implemented over a decade, stakeholders at these three different governance levels could engage in a process of ongoing dialogue in the coming years to help to prioritise support actions that could make the greatest difference to universities' ongoing transformations.

A number of strategic recommendations have been developed, which integrate some of the most important actions. Where possible, an effort is made to link the recommendations to the legal base.

Many of these focus on support actions that address more than one module in parallel, reflecting the cross-cutting and mutually-supportive nature of the modules and actions identified. These could be mutually reinforcing in supporting the Vision's effective implementation. The main transformation module concerned (where appropriate) - and linkages with other modules - are therefore indicated where appropriate in brackets.

- **Recommendation 1.1 (TM1): Governance should be strengthened to enable universities to meet the likely challenges between now and 2030 to fulfil their R&I mission, and enable them to contribute to strengthening research in line with Art. 179 TFEU.**

Achieving R&I excellence across a broader range of universities will require **continued but enhanced (trans)national cooperation between universities in Europe.** This will necessitate reflection on which are the **optimal cooperation mechanisms**, and the

most **appropriate incentives structures** to foster good governance in a way that is conducive to, and supports such cooperation. This will also require reflection on the optimal balance between soft instruments, such as funding support to strengthen technical capacity in particular areas (e.g. capacity-building to deliver Open Science), and also consideration of legal instruments, but only where soft measures are proven to be insufficient, or where sudden changes in circumstance requiring urgent policy action.

After years of promoting the **international mobility of researchers**, most but not all barriers to physical mobility have been removed. However, this has resulted in skewed mobility within Europe, which could risk exacerbating brain drain. Therefore, the EU should **rethink mobility** in its physical form in terms of 21st century alternatives such as online collaboration that would strengthen research, innovation and the economy locally across the EU, notably by investing in secure high-speed network facilities (in line with the Digital Education Action Plan and the Green Deal, and more widely supporting all citizens). Large-scale EU funded research infrastructures should benefit user groups across the EU and be managed as common goods. A more **balanced distribution** of research capacity can make European R&I more resilient in the long term and contribute to the cohesion of the EU.

- **Recommendation 1.2 (TM1): A governance process to oversee the implementation of the Vision and those aspects of the transformation modules identified by universities as being relevant to their identified needs would be beneficial.**

As there is a distinction between the various levels of governance (EU, national, and institutional), the importance of a formal, structured and continuous dialogue between the various political levels and stakeholders should therefore be underlined.

- **Recommendation 2 (TM1): The EU should consider creating an enabling legal framework for (trans)national cooperation between universities in Europe.**

The enabling framework should be based on existing EU competences in R&I (and education) but can also draw on competences in other Treaty chapters, such as internal market, free movement and commercial policy in order to pursue ERA and EEA objectives. Those areas of competence are underused so far in the knowledge domain.

The EU should equally explore the increased use of existing legal instruments (e.g. ERIC and EGTC[378]), as these have been under-utilised by universities, with low levels of awareness about their existence and purpose.[379]

The EU should consider the possible creation of new legal instruments (e.g. a **European University Statute**), but only if identified need can be demonstrated following a feasibility study. An analysis of existing types of legal entities and the actual needs and challenges of (trans)national partnerships should be first undertaken. This would include, but not be limited to, the alliances established under the European Universities Initiative (EUI).

The feasibility should be considered of adopting a short **Framework Directive** that would stipulate the goals, principles, instruments, actors and actions in the field of research and innovation and give EU citizens the right to challenge national legislation if this impedes the full realisation of the ERA could also be explored. This would pose no active obligations

[378] The European Research Infrastructure Consortium (ERIC) is a specific legal form that facilitates the establishment and operation of Research Infrastructures with European interest. The European Grouping for Territorial Cooperation (EGTC) is a European Union level form of transnational cooperation between countries and local authorities with legal personality.

[379] Comandè, F, L. Kortese, L. (2020). *Analysis of current legal framework and possibilities of the development of legal instruments in European Union law in support of education, research and innovation Policies*. Brussels. (unpublished).
Hoogenboom, A and Kwikkers, P. (2020). *Analysis of possible synergies between education, research and innovation policies*. Brussels. (unpublished).

on the Member States, but only passive prohibitions. MS should refrain from introducing any domestic legislation that blocks the free circulation of knowledge, specifically if these concern the five ERA priorities. Such a Directive should respect the principles of EU actions as laid down in the Treaty on the Functioning of the European Union: attribution, subsidiarity and proportionality. It would help to enhance the effectiveness of **national research systems** (the first ERA priority) and should not primarily aim at more physical mobility, i.e. to avoid brain drain.

- **Recommendation 3 (TM3): Raise the number of universities in Europe able to deliver excellent science, by building on cooperation and networks as part of a systems-based approach. This could contribute to Art. 179 TFEU.**

The EU could support and complement national investments, pooling, merging and aligning of policies with a Europe-wide **excellence initiative,** fostering a selection of **word-class universities**, a series of highly integrated collaborative **networks** (European Universities, KICs) and an ERA-based upgrade of **national R&I systems.** This would then enable Europe's top institutions to be able to cooperate and compete globally, whilst being a well-embedded part of regional and national eco-systems.

However, a better benchmarking system against which progress made by Europe's universities towards achieving (and being recognised for) excellent research is arguably needed, as existing global performance indexes for universities have their limitations.[380] Support measures could be provided at European level to strengthen excellent research in itself, to strengthen the reputation management of European universities and to consider assessment of the balanced contribution to the SDG's, or implementation of open science practices, as indicators for university achievement. However, caution is needed against overly-simplistic ways of measuring universities contribution to achieving the SDGs (see main report – TM3).

- **Recommendation 4 (TM3): Scientific and research excellence needs to be reflected in the quality of research across the entire research pipeline, including the objective of strengthening basic research as an explicit objective.**

This could make a valuable contribution in key strategic areas of European policy importance (such as Artificial Intelligence).

- **Recommendation 5 (TM3): Widen the range of universities that are able to gain access to competitive research funding by spreading excellence, as this would be beneficial for universities across Europe as a whole.**

Whilst lifting more universities into the realm of world-class excellence in R&I should remain a priority, continuing the current model of intensive competition could lead to the over-concentration of EU funding among Top 20 universities (with attendant brain drain risks) to the detriment of the overall growth and prosperity of higher education, and its valuable research mission. Therefore, the widening agenda initiated in Horizon 2020 should be reinforced in Horizon Europe.[381] This will require working towards strengthening existing centres of excellence within EU13 countries and their regions.

- **Recommendation 6 (TM3): Performance measurement and benchmarking systems against which progress made by Europe's universities towards achieving (and being recognised for) excellent research are needed. These should move beyond existing ranking systems, as current global performance**

[380] Examples include the ARWU, THE and QS rankings.
[381] Whilst widening participation will be a key objective in the new Horizon Europe programme, this may require rethinking how avoidance of over-concentration of competitive funding might be achieved in practice. The portability of grants leads to such concentration, but is linked to the relative and excellence of Host Institutions (e.g. the ERC grants), therefore, this would be difficult to overcome without programmatic reform.

indexes for universities [382] have their limitations.

Caution is needed in avoiding overly-simplistic ways of measuring universities' research performance, or indeed other aspects. Presently, external perceptions of institutional reputation contribute to university's rankings under current metrics systems, as well as other metrics not necessarily linked to research excellence, such as teaching and research in the English language, and the level of funding, which is influenced by many factors other than research quality. Instead, EU support measures could be provided to enable universities to strengthen their capacity to deliver excellent research. Moreover, wider use of alternative metrics to existing rankings systems could be considered, such as an assessment of the balanced contribution by universities to the sustainable development goals (SDG's) as an indicator. However, again, even with ranking systems beyond the ARWU and QS rankings, the methodology for alternative rankings, such as the THE's ranking system on universities' progress towards the SDGs needs further development, and cannot yet be considered 'state of the art' (see case study in TM3).

- **Recommendation 7 (TM3): Universities should adopt this vision and depending on their identified transformation needs, embrace those transformations required to improve the performance of universities in their R&I missions.**

This would in turn make them more successful at competitive research funding in a way that lifts all universities in Europe and creates more global winners.

- **Recommendation 8 (TM3): The widening participation agenda initiated in Horizon 2020 should be reinforced in Horizon Europe, but not in a way that diminishes the focus on scientific and research excellence.**

The range of universities across Europe able to gain access to competitive research funding should be widened through a process of spreading excellence. Whilst lifting more universities into the realm of world-class excellence in R&I should remain a priority, the current model of intensive competition could lead to the over-concentration of EU funding among the leading universities that dominate the host institutions for portable ERC grants and MSCA grants (with attendant brain drain risks) to the detriment of the overall growth and prosperity of higher education, and its valuable research mission.

- **Recommendation 9 (all TMs): Foster interdisciplinary collaboration as a key to successful research impact.**

Societal challenges are complex and need to be addressed with the widest possible range of expertise and the input of a broad range of stakeholders from across society. Research systems need more flexible structures in terms of organisation, task description and reward processes, in order to facilitate, promote and reward active STEM-SSH involvement in the design and execution of research activities.

- **Recommendation 10 (TM3): Support more universities to engage in strategic R&I planning processes.**

Whilst many universities have already developed institution-specific R&I strategies, more universities in Europe – including in widening countries - should be supported in doing so. A transfer of experience and know-how could be made from the many universities that have experience in developing, publicising, and updating research strategies across the EU, which involve external stakeholders (who often sit on university Boards) to those universities that lack such experience.

[382] Examples are the ARWU, THE and QS rankings.

Universities could be encouraged to develop, make public and transparent, and periodically update their research strategies.[383] These could specify the extent of focus on different types of research activities e.g. fundamental, applied, disciplinary strengths, future priorities and identified needs, etc. The strategic R&I agenda at EU level is a further dimension that could be considered and provide inspiration when universities' draft their own research agendas, given strong interest in contributing through R&I activities to societal challenges.

- **Recommendation 11 (TM3): Promote greater synergies between curiosity-driven research and the directionality provided at EU level through the strategic R&I agenda relating to the societal challenges.**

Many universities across Europe have expressed interest in contributing to developing approaches of respond to a wide range of societal challenges, especially the SDGs. Universities are therefore already working on balancing curiosity and challenge-driven research as part of developing and revising their research strategies. Curiosity-driven research is very important in contributing to broad and long-term EU policy objectives, such as the SDGs and the Green Deal. The Commission should support the development of the strategic capacity of universities, wherever it can bring European added value.

- **Recommendation 12 (TM3, TM4, TM5, TM6, TM7): There should also be a continuing focus on ensuring effective science communication by researchers, universities (and by research funders at local, regional, national and EU levels), on communicating key scientific research findings to EU citizens, societal actors and policy makers.**

This would have multiple benefits ranging from increasing public understanding and trust in science to strengthening communications as to the achievements of longer-term fundamental research and their potential relevance to addressing not only longer-term, but also nearer-term policy challenges. Whilst many universities (and some researchers) are already highly adept at such communications, others – especially in a widening context - could benefit from the sharing of best practices in this area.

- **Recommendation 13 (TM4, TM5 and TM6): Reform universities' career development, training and appraisal, recognition and incentives systems and structures.**

The recommendation for a more holistic, quality-driven and less quantity-driven evaluation model is embedded in the 'human resource' module. This could also encourage greater inter-sectoral cooperation and researcher mobility, and strengthening the adoption of Open Science practices at an institutional level and at the level of individual researchers, which would be accelerated if there were better career recognition for researchers adopting these practices. Universities are taking the initiative to review their approaches, but a systemic reform on the regional, national and EU level, collaboratively with research-funding organisations, is a shared responsibility and requires the support of and partnership between the main actors.

- **Recommendation 13.1 (TM4 and TM6): Reform researcher career assessment.**

There should be balanced assessment based on the full spectrum of a researchers' capabilities in a manner relevant to career stage and position sought and other relevant contextual factors, avoiding a one-size-fits-all approach to researcher career assessment. The assessment should take into account, depending on contextual factors, research output; the research process (including Open Science, stakeholder engagement/citizen science, collaboration and interdisciplinarity and research integrity); service and leadership; research impact (including communication & dissemination, IP exploitation and open knowledge exchange with non-academic partners); teaching and supervision; and

[383] A challenge identified was that these research agendas may not be openly communicated, and doing so earlier would allow for inter-institutional "tuning" can be facilitated, especially where universities are cooperating with other universities that have similar research strengths to enhanced coherence.

other professional experiences.

- **Recommendation 13.2 (TM4 and TM5): Embed skills training and professional development for researchers at all levels (R1-R4).**

Building research excellence requires investment in the training and career development for researchers at all levels (R1-R4), especially for the large number of researchers at R1 and R2 levels (PhD and postdoc) the majority of whom will not have permanent employment in the academic sector. Universities should see this as a long-term investment in researchers, whereby most will end up working in other institutions and sectors, and will create a community of highly talented people across many sectors for future intersectoral collaborations. This will need agreement between universities and funders to provide protected time for career development (training etc.), especially for researchers at R1 (PhD) and R2 (postdoc) levels.

- **Recommendation 13.3 (TM4): The concept of geographical mobility should be extended to include virtual mobility.**

Given the widespread use of digital communication platforms, virtual mobility could be formally recognised as a basis for research practice and assessment. This could bring about greater equality and would also enable researchers in the widening countries regions to access well-resourced labs and foster international collaboration. In the European context. this could go some way towards improving the retention of researchers in those widening countries. However, this will not be appropriate in all circumstances, as a lot of research is physically laboratory-based. Indeed, some research activities have been severely impaired during the Covid-19 crisis). Success will be largely dependent on the overall conditions of institutions, and the national context in widening countries. If a university establishes connections to enable researchers to work in an internationalised environment, and establishes appropriate networks, etc., then this could also improve retention. Therefore, it is about both the institutional approach and not only the fact that the researcher can take part in virtual mobility.

- **Recommendation 13.4 (TM4): Update the European Charter for Researchers and Code of Conduct for their Recruitment.**

A renewed Charter should be responsive to the changed EU research and innovation landscape and reflect the state of contemporary discussions within the academic sector. It should also explicitly take into account Open Science, open innovation practices, gender/diversity, research integrity, citizen science and quadruple i-mobility (transnational, intersectoral, interdisciplinary and virtual) in career development. The Code for Recruitment of Researchers should include a much broader assessment of researcher activities (Open Science Career Assessment Matrix OS-CAM) in recruitment and career development.

- **Recommendation 14 (TM5, TM6): Secure stronger engagement by more universities and researchers in citizen science.**

This could help firstly to maximise the societal impacts of research, including EU-funded research, and secondly to contribute to open science and strengthen scientific literacy among citizens and politicians. Moreover:

- Citizen science is a means of increasing the collective capabilities and scope of research and ensuring the ongoing relevance of research to society and scientific literacy of the population, which is important to maintain public trust and to strengthen public interest in science and research.
- Direct engagement of citizens in research, in turn, could have a positive effect on the perception of the usefulness of science and the uptake of innovation in society. This has wide-ranging impacts as EU citizens become more directly involved in research from conceptualisation through to implementation, assessment and impact. Opening the university towards society in this manner would also broaden interest among young people in pursuing research and scientific careers, and widen the audience for research

papers, especially when combined with open access and open data policies to scientific outputs produced by universities.

- Strengthening citizen engagement in research supports teams and projects by increasing the resources to shape research agendas, data collection, analysis, and research dissemination. The challenges related to conducting citizen science should however be explicitly acknowledged, especially those related to the ownership of research outcomes, and responsibility for the integrity of the research process.

- **Recommendation 15 (TM5 and TM4): Maintain and strengthen interaction between academia and non-academic sectors to reinforce universities' role as central actors at the heart of innovation ecosystems**.

The integration and active role of universities in innovative ecosystems at European, national, regional, local and city levels will be essential in future, not only in exploiting their expertise from across society to address societal challenges, but also in order to create a positive societal engagement and significantly contribute to raising public awareness on the added-value of research and innovation investments. This will also require greater recognition by universities in recruitment and career progression of experience in other sectors in order to facilitate inter sectoral mobility.

- **Recommendation 16 (TM6 and TM4): Empower more universities in Europe to embrace and adopt Open Science, and to pursue open access and open data policies, drawing on existing EU investments[384].**

The move towards Open Science brings complex challenges for universities which will not only need to open up their data and services but will also have to connect with other to combine these across disciplines. A challenge will be to develop interoperable, FAIR standards across disciplines. Researchers practising Open Science will need to be recognised, incentivised and rewarded though a reform of recruitment and career progression methods (OS-CAM).

- **Recommendation 16.1 (TM6): Foster and accelerate the access to research outputs and facilitate cross-disciplinary and AI-enhanced research that can address the societal challenges of our times.**

Universities can support the transition to Open Science by promoting and rewarding the publishing of research outputs in open journals and platforms as well as the FAIRification and opening of research data sets. Dedicated support for researchers is needed at universities in the form of open access policies, data management plans, and (FAIR) data stewardship.[385]

- **Recommendation 16.2 (TM6 and TM4): Provide training for researchers at all levels (R1-R4) in the practice of open science.**

In order to facilitate the practice of open science, researchers will need training in a range of skills, including open access publishing, open peer review, open data and FAIR data management, open access to other research outputs, and efficient access to open knowledge. In addition, researchers need training regarding ethics and research integrity, and also on practices to ensure the reproducibility of results, as well as societal engagement including citizen science. This training will be critical to enable researchers to deal with IPR and GDPR issues in an open science context.

[384] The EOSC will help to create a web of interoperable e-infrastructures via FAIR and open protocols where researchers will be able to find and exploit the data sets they need.
[385] The FAIRification of research data sets is a first step to making data interoperable and connected via the European Open Science (EOSC), allowing for the combination of research data across disciplines and the deployment of Artificial Intelligence on FAIR data, to enable new discoveries for the benefit of science and society

- **Recommendation 17: Accelerate the ongoing digital transformation of universities in Europe.**

Whilst many universities have adopted different digitalisation practices, digital transformation requires going beyond the digital skills agenda stressed in previous Commission Communications[386] to encompass a broader range of digital-related issues. Digitalisation is relevant to the Open Science module (TM6)[387], to optimising the use of e-research infrastructures (TM6), and increasingly to research activities themselves. Moreover, the COVID-19 pandemic has reinforced the need for investing more in making university research and teaching content more easily and virtually available to students, researchers and wider communities (respecting IPR where necessary). This means that virtual mobility should be recognised as complementing physical mobility in the context of career development (TM4). However, it should also be considered that some mobility by definition requires some form of physical mobility e.g. laboratory-based research activities.

- **Recommendation 18: (TM5, TM6, TM4): Support universities to enable them to make use of Artificial Intelligence (AI), where relevant, either for research purposes, or in their operations. The EU should support universities in exploring potential use cases of AI.**

As with many other sectors, there are many opportunities arising from greater use of Artificial Intelligence by universities. However, it should be stressed that this is not a means in itself. AI technologies might be relevant in some cases in a university setting e.g. in carrying out research, facilitating open data implementation, especially meta data, monitoring research impacts. However, they will need to reflect on how AI can be safely implemented to address their specific needs, whilst respecting ethical norms.

- **Recommendation 19: The unique needs of research when regulating the digital space in general and AI specifically should also be taken into account.**

An example is that the EU's 2019 Copyright Directive on the Single Market includes Article 3 on Text and Data Mining (TDM) for research purposes. Such legislation can accommodate the use of big data for research purposes by universities, for instance, in training AI and machine learning tools. Future potential EU horizontal regulation on AI should also consider research needs to ensure that AI can be deployed effectively by universities in their research missions.

- **Recommendation 20: (TM7). Strengthen the management of universities' Research Infrastructures (RI) in Europe.**

- **Recommendation 20.1: An inventory should be carried out to identify national legislation that prohibits universities to own, manage and operate infrastructures. Any legal barriers to universities owning, managing and operating RIs should be removed.**
- **Recommendation 20.2: Deliver and maintain scientific excellence and secure appropriate, stable funding for the long-term sustainability of RIs across Europe.** Acknowledging the role of universities, especially research universities, in delivering excellence is crucial.
- **Recommendation 20.3: Research universities should be encouraged design institutional infrastructure roadmaps and to professionalise their management and operation of infrastructures through the sharing of best practices.** As part of this process, universities should be encouraged to align their infrastructure cycles with those at national, European and global levels.
- **Recommendation 20.4: Sustainable governance of RIs has to be ensured**

[386] https://ec.europa.eu/digital-single-market/en/policies/digital-skills
[387] The role of open access, facilitated through the EOSC and thematic digital platforms connecting researchers across Europe is especially relevant.

through long-term vision and national funding commitments to complement EU funding. National authorities should also be encouraged to ensure that adequate national sources of funding are made available for this purpose. There has previously been a focus on using EU support to fund new RIs.

- **Recommendation 20.5: However, special support actions might be needed to boost the optimal use by universities of EU funding programmes such as Horizon and ESIF.** Universities should be given better guidance as to how to use EU funding from Horizon and ESIF more effectively to support the maintenance and/ or upgrading of their existing infrastructures. This could include exploring the scope to combine different funding sources where appropriate.
- **Recommendation 20.6: Attracting highly-qualified researchers and staff to operate and maintain RIs will be key and national research and education systems should be strengthened and harmonised to ensure the right skills are available.**

- **Recommendation 21: Access to research infrastructures in universities and to external infrastructures by researchers based at universities (e.g. owned by the private sector, research institutes) should be improved. This could include remote access.** This could be achieved *inter alia,* by coordinating and synchronising roadmaps and RI business plans, Update the European Charter for Access to Research Infrastructures). Remote access to research infrastructures could also be considered, as some university networks (e.g. the University of the Seas) are already looking into this possibility.[388]
- **Recommendation 21.1 (TM7): Foster the accessibility of state-of-the-art research infrastructures.** To address the currently imbalanced utilisation of RIs and to maximise access, innovative and more effective means of coordinating and synchronising roadmaps and RI business plans should be organised. This should be supported by the promotion of multidisciplinary cooperation between universities and industry, the public sector and civil society, thereby exploiting the innovation potential of RIs. The virtual access for researchers to RIs, and the data sets and services they offer, can be further improved and facilitated by connecting and integrating RIs where applicable to the European Open Science Cloud (EOSC).
- **Recommendation 21.2 (TM7): Update the European Charter for Access to Research Infrastructures** and provide EU support to help ensure its effective implementation at an institutional level, including the sharing of best practises on the management and operation of infrastructures at universities.

- **Recommendation 22 (all TMs): Enable universities to respond to changes within European society itself, such as increased diversity, by mainstreaming core European constitutional values set out in the Treaties and elsewhere such as equal opportunities (including gender equality) and inclusiveness.** Inclusiveness should be understood as being among a number of horizontal issues to be mainstreamed. The concept relates partly to the need to consider non-discrimination and diversity principles in implementing the actions envisaged, but also as a broader concept as to how universities can engage with different sectors and with societal actors, communities and citizens locally, regionally, nationally and at European level.

[388] The European University of the Seas is comprised of a number of different universities, including the University of Cadiz, University of Bretagne Occidentale, Kiel University, University of Gdańsk, University of Split and the University of Malta. https://sea-eu.org

Annex 1 - Bibliography

Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
EU Policy Documents				
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EU	2019	Green Paper	The EU mission in education and research: available legal tools for policy development in the next decade and beyond	European Commission
EU	2019	Proposal for a Decision	Proposal for a Decision on the Strategic Innovation Agenda of the European Institute of Innovation and Technology (EIT) 2021-2027: Boosting the Innovation Talent and Capacity of Europe. https://ec.europa.eu/education/sites/education/files/document-library-docs/proposal-decision-eit-2021-2027.pdf	European Commission
EU	2019	Factsheet	Factsheet: EU FUNDING FOR RESEARCH AND INNOVATION 2021-2027	European Commission
EU	2018	Proposal for a Regulation	Proposal for a Regulation establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination (COM/2018/435 final)	European Commission
EU	2018	Annexes to Proposal for a Regulation	Annexes to the proposal for a Regulation establishing Horizon Europe	European Commission
EU	2018	Proposal for a Decision	Proposal for a Decision establishing the specific programme implementing Horizon Europe – the Framework Programme for Research and Innovation COM(2018) 436 final	European Commission
EU	2018	Annexes to Proposal for a Decision	Annexes to the proposal for a Regulation establishing the specific programme implementing Horizon Europe	European Commission
EU	2017	Commission Communication	Commission Communication - COM(2017) 247 Communication on a renewed EU agenda for higher education	European Commission
EU	2011	Commission Document	Principles for Innovative Doctoral Training https://euraxess.ec.europa.eu/sites/default/files/policy_library/principles_for_innovative_doctoral_training.pdf	European Commission
EU	2003	Commission Communication	Commission Communication - COM(2003) 58 Communication: The role of the universities in the Europe of knowledge	European Commission
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EU	2015	Study Report	The Knowledge Future: Intelligent policy choices for Europe 2050, Study Report	DG RTD, European Commission
EU	2013	Study Report	Open Education 2030: Planning the Future of Adult Learning in Europe, Study Report.	JRC

Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
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The European Research Area (ERA) and position papers on a renewed ERA				
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EU Association	2020	Position paper	Empowering Europe's scientific leadership through a renewed European Research Area - https://www.the-guild.eu/publications/guild-position-on-era-renewal.pdf	The Guild
EU	2019		The European Research Area	European Commission
EU	2019	Position Paper	Future of the European Research Area (ERA)	CESEAR
EU	2015	Position paper	ERAC Opinion on the European Research Area Roadmap 2015-2020	
EU	2001	EC Directive	Directive 2001(95) EC of the European Parliament and of the Council on General Product Safety	European Commission
EU	-	Position paper	Summary report: ESFRI Workshop on the Future of Research Infrastructures in the European Research Area	European Strategy Forum on Research Infrastructures
The European University landscape				
EU	2017	Publication	The Prominence of the Napoleonic Model of Higher Education in the Knowledge Economy. International Scientific Journal of Universities and Leadership.	Doh, Pascal & S.Doh, Bilola.
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EU	2012	Publication	State and Market in Higher Education Reforms	Mendiola G.Á.
EU	2008	Publication	The European university landscape: A micro characterization based on evidence from the Aquameth project	Cinzia Daraioa, AndreaBonaccorsi et al.
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Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
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EU	2017	Study	The Prominence of the Napoleonic Model of Higher Education in the Knowledge Economy. International Scientific Journal of Universities and Leadership.	Doh, Pascal & S.Doh, Bilola
EU	2015	Report by high-level group for the European Commission	The Knowledge Future: Intelligent Policy Choices for Europe 2050	DG RTD
EU association	2008	Study report	What are universities for?	LERU, Geoffrey Boulton and Colin Lucas
EU	2015	Study report	Key long term transformations in Research, Innovation and Higher Education 2050. Report by an expert group on Foresight on Key Long-term Transformations of European systems: Research, Innovation and Higher Education (KT2050)	DG RTD, European Commission
-	2018	Study Report	Future University Thoughtbook initiative - http://futureuniversities.com/thoughtbook/	Todd Davey et. al. University Industry Innovation Network
Governance (TM1)				
EU	2019	Independent Expert Report	Governing Missions in the European Union, Independent Expert Report	Mariana Mazzucato for DG RTD, European Commission
EU	2019	Study Report	Efficiency, Effectiveness and Value for Money at Universities, Study Report	European University Association (EUA)
EU	2019	Commission Declaration	Towards a Framework for Higher Education, Research and Innovation in the European Union	Ursula von der Leyen, European Commission
EU	2019	Academic Paper	Decentring European higher education governance: The construction of expertise in the Bologna Process	Dorota Dakowska
EU	2019	Position Paper	Future of the European Research Area (ERA)	League of European Research Universities (LERU)
EU	2019	Study Report	Legal instruments in support of EU policies in education, research and innovation	P van der Hijden, Lavinia Kortese
EU	--	Study Report	Governance Framework for the Higher Education System (IRELAND), Study Report	Higher Education Authority (Ireland)
EU	2009	Study Report	University Autonomy In Europe I, Exploratory Study	European University Association (EUA)
EU	2008	Study Report	Global Trends in University Governance	World Bank
EU	2019	Study Report	Pros and Cons of Distribution Streams of Governmental Funding for Research, Study Report	Swedish Research Council for Sustainable Development
EU	2017	Study Report	University Autonomy in Europe III: Country Profiles	European University Association (EUA)
EU	2016	Declaration	Declaration on Academic Freedom	Association of Human Rights Institutes (AHRI)

Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
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EU	2012	Academic Paper	Governance Within the EHEA: Dynamic Trends, Common Challenges, and National Particularities	Middlehurst & Teixeira
EU	2012	Academic Paper	University Governance Models: The Case of Lapland University	Barzelis, Mejere, Saparniene
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EU	2020	News Article	Researchers suffering 'shocking' levels of stress, poll reveals	Science Business
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Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
			Forum for Enhanced Collaboration in Teaching (EFFECT) project	
EU	2017	Study Report	More3: Mobility Patterns and Career Paths of EU Researchers https://cdn1.euraxess.org/sites/default/files/policy_library/final_report_2.pdf	IDEA Consult, WIFO and Technopolis, DG RTD
EU	2018	Study Report	Study on Fostering Industrial Talents in Research at European Level	DG RTD, European Commission. Authors, Whittle et al.
EU	2017	Study Report	FP7 ex post and H2020 interim evaluation of Marie Skłodowska-Curie actions	DG EAC, European Commission
Academia-Business Co-operation and Entrepreneurial (TM5)				
EU	2018	Discussion note	The Entrepreneurial and Innovative Higher Education Institution: A Review of the Concept and its Relevance Today	HEI Innovate
EU	2019	Journal article	The entrepreneurial university as driver for economic growth and social change - Key strategic challenges	Klofsten et al.
EU	2019	Journal article	Science Parks, talent attraction and stakeholder involvement: an international study	Klofsten et al.
EU	2019	Workshop Agenda	Workshop on Connecting with the entrepreneurial ecosystem	European Commission/TTO Circle
EU	2019	Workshop Report	Connecting with the Entrepreneurial Ecosystem: TTO Circle Workshop Report	EC JRE
EU	2019	Project Report	University-Industry Collaboration: New Evidence and Policy Options	OECD
EU	2019	Journal article	Sustainable Idea Development Mechanism in University Technology Commercialization (UTC): Perspectives from Dynamic Capabilities Framework	Cho, Boon Kwak, & Jun.
EU	2019	Publication	Social Innovation: Comparative Perspectives	Multiple authors
EU	2018	Discussion note	The Entrepreneurial and Innovative Higher Education Institution: A Review of the Concept and its Relevance Today	HEI Innovate
EU	2018	White Paper	Role of Universities of Science and Technology in Innovation Ecosystems: Towards Mission 3.1	CESEAR
EU	2018	Case Studies Report	Study on Fostering Industrial Talents at European Level: Case Studies Report	DG RTD
EU	2017	Compilation of Documents	Background Text on academia-business cooperation	(see references at end of doc)
EU	2017	Journal article	Sustainability-profiled incubators and securing the inflow of tenants: The case of Green Garage Berlin	Klofsten et al.
EU	2017	Journal article	The UBC Ecosystem: Putting Together a Comprehensive Framework for University-Business Cooperation	Galán-Muroz, V. & Davey, T.
EU	2017	Review/Report	Social Innovation as a Trigger for Transformations: The Role of Research	DG RTD
EU	2016	Journal article	Entrepreneurial universities: emerging models in the new social and economic landscape. Small Business Economics, 47(3), 551-563.	Guerrero, M., Urbano, D., Fayolle, A., Klofsten, M., & Mian, S

Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
EU	2016	Journal article	PhD students in the entrepreneurial university-Perceived support for academic entrepreneurship. European Journal of Education, 51(1), 56-72.	Bienkowska, D., Klofsten, M., & Rasmussen, E.
EU	2016	Systematic Review	Universities—industry collaboration: A systematic review. Scandinavian Journal of Management. 31. 10.1016/j.scaman.2015.02.003.	Ankrah, Samuel & Al-Tabbaa, Omar.
EU	2015	Report	Nurture over Nature: How do European Universities Support Their Collaboration with Business?	Galán-Muros et al.
EU	2015	Journal article	Determinants of the university technology transfer policy-mix: a cross-national analysis of gap-funding instruments	Munari et al.
EU	2015	Study report	Does context matter in academic entrepreneurship? The role of barriers and drivers in the regional and national context	Davey, Rossano & van der Sijde
EU	2015	Journal article	What Drives and Inhibits University-Business Cooperation in Europe? A Comprehensive Assessment	Galán-Muros & Plewa
EU	2014	Study report	A Comparison of the State of University-Business Cooperation in Germany and Poland	Baaken et al.
EU	2014	Journal article	Learning in University technology transfer offices: transactions-focused and relations-focused approaches to commercialization of academic research	Weckowska, D. M.
EU	2012	Journal article	An Entrepreneurial University Strategy for Renewing a Declining Industrial City: The Norrköping Way	Klofsten et al.
EU	2012	Journal article	Creating entrepreneurial networks: academic entrepreneurship, mobility and collaboration during PhD education. Higher Education, 64(2), 207-222.	Bienkowska, D., & Klofsten, M
EU	2012	Journal article	Organizational Factors that Affect the University-Industry Technology Transfer Processes of a Private University	Closs et al.
EU	2011	Journal article	Mind the gap and bridge the gap: research excellence and diffusion of academic knowledge in Sweden	Wirgen-Kristoferson, Gabrielsson & Kitagawa
EU	2009	Report	30 Good Practice Case Studies in University-Business Cooperation	European Commission
EU	-	Presentation	Student Entrepreneurship at research intensive universities: from a peripheral activity towards a new mainstream	Sheron Shamuilia, EC JRC
EU	-	Journal article	University-Business Cooperation Outcomes and Impacts — A European Perspective	Davey, Galán-Muroz & Plewa
Open Science and Open Access (TM6)				
EU	2020	Statement	Researchers call on EU institutions to ensure free circulation of scientific knowledge	Eurodoc
EU	2020	White paper	Advancing Research Data Management in Universities Of Science and Technology	CESAER
EU	2020	White paper	Open Access in Horizon Europe	CESAER
EU	2019	Study Report	Mutual Learning Exercise on Research Integrity	DG RTD, European Commission
EU	2019	Strategy Document	European Open Science Cloud (EOSC) Strategic Implementation Plan	DG RTD, European Commission

Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
EU	2019	Position Paper	Rewards and incentives for OS: Examples of principles and good practice	VSNU, NFU, KNAW, NWO and ZonMw
EU	2019	Study Report	Indicator frameworks for fostering open knowledge practices in science and scholarship	DG RTD, European Commission
EU	2019	Strategy Document	European Open Science Cloud (EOSC) strategic implementation plan	DG RTD, European Commission
EU	2019	Working Paper	ERAC Opinion on the Future of ERA	General Secretariat of the Council
EU	2019	Expert Paper	Revised Plan S principles and implementation guidance	Science Europe
EU	2019	Study Report	Research assessment in the transition to Open Science – 2019 EUA Open Science and Access Survey results	EUA
EU	2019	Expert Report	Room for everyone's talent – towards a new balance in recognising and rewarding academics	Dutch Public Knowledge Institutions
-	2019	Expert Report	Hong Kong principles for assessing researchers: fostering research integrity	Various authors
EU	2019	Announcement	Research Assessment for Researchers' Recruitment and Career Progression	European University Association (EUA)
EU	2018	Study Report	Open Science Policy Platform Recommendations	DG RTD, European Commission
EU	2018	Study Report	Turning Fair Into Reality (Fair Data). Final Report and Action Plan from the European Commission Expert Group on FAIR Data	DG RTD, European Commission
EU	2018	Study Report	Recommendations by the ERAC Standing Working Group on Open Science and Innovation (SWG OSI) on "open science and innovation"	DG RTD, European Commission
EU	2018	Study Report	Mutual Learning Exercise on "Open Science - Altmetrics and Rewards	DG RTD, European Commission
EU	2018	Advice Paper	Open Science and its role in Universities	League of European Research Universities (LERU)
EU	2017	Study Report	Evaluation of Research Careers fully acknowledging Open Science Practices	DG RTD, European Commission
EU	2017	Study Report	Providing researchers with the skills and competencies they need to practise Open Science	DG RTD, European Commission
EU	2017	Study Report	Next-generation metrics: Responsible metrics and evaluation for open science	DG RTD, European Commission
EU	2017	Study Report	Evaluation of research careers fully acknowledging Open Science practices	DG RTD, European Commission
EU	2017	Expert Paper	Report on the governance and financial schemes for the European Open Science Cloud	Open Science Policy Platform
EU	2017	Expert Paper	Recommendations on Open Science Publishing	Open Science Policy Platform
EU	2017	Book Chapter	Rethinking civil society organisations working in the freedom of information and open government data fields	Schalkwyk, F. v. & Verhulst, G.
EU	2016	Publication	Open Innovation, Open Science, Open to the World	DG RTD, European Commission
EU	2016	Council Conclusions	The Transition towards an Open Science System	General Secretariat of the Council

Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
EU	2015	White paper	Roadmap towards Open Access	CESAER
EU	2015	Expert Paper	Leiden Manifesto for Research Metrics	Diana Hiks, Paul Worter, et al.
EU	2015	White paper	CESAER going towards Open Science	CESAER
US	2013	Declaration	San Francisco Declaration on Research Assessment	Declaration on Research Assessment (DORA)
EU	2012	Commission Recommendation	Commission Recommendation on access to and preservation of scientific information	European Commission
Research Infrastructures (TM7)				
EU	2017	Work Programme	Horizon 2020 Work Programme 2018-2020: 4. European research infrastructures	European Commission
EU	2016	Declaration	European Charter for Access to Research Infrastructures: Principles and Guidelines for Access and Related Services	DG RTD, European Commission
EU	2013	Report	Research Infrastructures in the European Research Area	European Science Foundation
EU	-	Presentation	EU Research Infrastructures policy and the impact of the ESFRI Roadmap	Magda Ribeiro, DG RTD
EU	2017	Position Paper	Industry Innovation and the Role of Research Infrastructures	CERIC
EU	2017	White Paper	Four Golden Principles for Enhancing the Quality, Access and Impact of Research Infrastructures	LERU
EU	2019	Position paper	UNIVERSITIES OF S&T AS ENGINES OF EXCELLENCE, TALENT AND INNOVATION: ROLES IN RESEARCH AND INNOVATION INFRASTRUCTURES	CESAER
EU programmes and initiatives				
EU	2019	Presentation / factsheet	General presentation European Universities Initiative	DG EAC, European Commission
EU	2019	PowerPoint (DG RTD)	Present on Innovation Ecosystems in Horizon 2020	DG RTD, European Commission
EU	2019	PowerPoint (DG RTD)	Presentation on EU funding for innovation	DG RTD, European Commission
EU	2019	Factsheet (DG RTD)	Presentation on EUROPEAN INNOVATION COUNCIL	DG RTD, European Commission
EU	2019	PowerPoint (DG EAC)	New Features of the Marie Skłodowska-Curie Actions in Horizon Europe (2021-2027)	DG EAC, European Commission
Widening				
EU	2018	Study report (DG RTD)	Spreading Excellence & Widening Participation in Horizon 2020: Analysis of FP participation patterns and research and innovation performance of eligible countries	DG RTD, European Commission
EU	2019	Discussion note	The Widening Programme (EU instruments, including H2020)	DG RTD, European Commission
EU	2018	Discussion note	Horizon 2020 Work Programme 2018-2020: 15. Spreading Excellence and Widening Participation	DG RTD, European Commission
EU	2018	Study report	Overcoming Innovation Gaps in the EU-13 Member states	European Parliament

Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
EU	2019	Declaration	Declaration on Equality, Diversity and Inclusion at Universities of Science & Technology	CESEAR
Education				
EU	2019	Discussion Paper	Science & Technology Education for 21st Century Europe	CESAER
EU	2016	Policy Brief	Science education policies in the European Commission: towards responsible citizenship	SIS.net
EU	2015	Report	Science education for Responsible Citizenship	DG RTD
Digitalisation and Artificial Intelligence				
EU	2019	Position Paper	Preparing for the Changing Nature of Work in the Digital Era	OECD
-	2019	Skills Outlook report	Skills Outlook 2019 - Thriving in a Digital World	
EU	2018	Policy Brief	Putting faces to the jobs at risk of automation	OECD
EU	2018	Study	Digital transformation in German higher education: student and teacher perceptions and usage of digital media	Bond, Marín, Dolch et al.
EU	2018	Presentation	Universa and the Digital Transformation of Universities	Universa
EU	2017	Position Paper	Digital Transformation in Higher Education: Security and Mobilizing Digital Learning Environments to Enable Limitless Learning	vmware
EU	2017/ 18	Report	Digital Transformation in Higher Education	Navitas Ventures
-	2016	Policy Brief	Skills for a Digital World	OECD
EU	-	Guide	How to bring digital transformation to your Higher Education Institution	U Planner
Knowledge triangle and the quintuple helix model				
EU	2019	Study	The Role of Universities in Regional Innovation Ecosystems	Dr. Sybille Reichert, EUA
EU	2018	Study	Three frames for innovation policy: R&D, systems of innovation and transformative change	Schot, J. & Steinmueller, W. E.
EU	2017	Study	The Knowledge Triangle between Research, Education and Innovation — A Conceptual Discussion	Unger, M., & Polt, W.
EU	2017	Working Paper	A Typology of European Universities. Differentiation and Resource Distribution. University of Sussex, SPRU Working Paper Series, Brighton	Lepori, B., Geuna, A., Veglio, V.,
EU	2012	Study	The Quintuple Helix Innovation model: global warming as a challenge and driver for innovation	Carayannis, E. G., Barth, T. D., & Campbell, D. F. J.
EU	2011	Publication	Mode 3 Knowledge Production in Quadruple Helix Innovation Systems, 21st-Century Democracy, Innovation, and Entrepreneurship for Development	Elias G. Carayannis, David F.J. Campbell
Social Impacts				
EU	-	Declaration	Declaration Societal Readiness Levels (SRL) defined according to Innovation Fund Denmark	SRLS
Autonomy and academic freedom				

Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
Global	2019	Book Chapter	Neo-Nationalism and Universities: Global Perspectives on Politics and Policy and the Future of Higher Education	Marijk van der Wende
Other				
EU	2018	Position paper	Shaping European universities of the future: The Guild's recommendations for the European Universities initiative	The Guild of European Research-Intensive Universities
EU	2018	Discussion note	THE FUTURE OF UNIVERSITIES THOUGHTBOOK	University Industry Innovation Network
EU	2019	Study Report	Doctoral education in Europe today: approaches and institutional structures	European Universities Association Council for Doctoral Education (EUA-CDE)
EU	2019	Position paper	YERUN Policy Response on the EIT (September 2019): Inclusive and open: this is how the EIT could support innovative higher education all over Europe	Young European Research Universities (YERUN)
EU	2019	Position paper	DECLARATION ON EQUALITY, DIVERSITY AND INCLUSION AT UNIVERSITIES OF SCIENCE & TECHNOLOGY	CESAER strong and united voice of universities of science and technology
EU	2019	Position paper	EUA Briefing: University Mergers in Europe	European University Association (EUA)
EU	2019	Presentation	European Universities Initiative: Why	European Commission
EU	2019	Position paper	Universities and the future of Europe	League of European Research Universities (LERU)
Europe and North America	2018	Discussion note	Europe and North America Education 2030 consultation	UNESCO, Council of Europe
EU	2016	Position paper	A joint vision for Secondary and Higher Education for All in Europe	European Students Union
Links with Other Sectors				
EU	2020	White Paper	On Artificial Intelligence - A European approach to excellence and trust https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf The White Paper on AI was published 19th February 2020.	European Commission
EU	2018	Article	Cocreation in higher education - towards a conceptual model - Article in Journal of Marketing for HIGHER EDUCATION · April 2018, DOI: 10.1080/08841241.2018.146675	Mollie Dollinger, Jason Lodge & Hamish Coates
EU	-	Study report	Study on the competitiveness of the EU engineering industries, 2019-2020	CSES, KMFA, IDEA Consult, Prognos, DECISION and partners. Study managed by EASME for Commission's DG GROW
EU Websites				
-	2020	Website	EACEA website on European Universities	EACEA

Country	Year	Type of Publication	Title and abstract (where relevant)	Authors
			https://eacea.ec.europa.eu/erasmus-plus/actions/key-action-2-european-universities_en	
-	2020	Website	EC website on European Universities with links to factsheets on the initiatives as such and on the 17 European Universities https://ec.europa.eu/education/education-in-the-eu/european-education-area/european-universities-initiative_en	DG EAC
-	2020	Website	Enhanced European Innovation Council (EIC) pilot https://ec.europa.eu/research/eic/index.cfm	DG RTD
-	2020	Website	Future of Education and Skills 2030 https://www.oecd.org/education/2030-project/	OECD

Annex 2 - Summary of organisations taking part in stakeholder events and / or providing feedback"

As noted in Section 1.3, a strong emphasis has been placed on a participatory approach to carrying out this study and in securing feedback and buy-in from relevant stakeholders, such as the university networks at European level, some individual universities and other relevant stakeholders.

A summary of organisations which either participated in the two stakeholder workshops or provided written feedback is provided below. It should be noted that many individual experts also participated from other institutions and/ or independents.

Stakeholder participation in workshops and / or written feedback on briefing paper

- The EUA
- The Guild
- CESAER
- YERUN
- The ACA
- The Coimbra Group
- Academia Europaea
- Business Europe
- SPARC Europe
- The Norwegian University of Science and Technology (NTNU)
- The Norwegian Ministry of Education and Research
- The University of Lille
- The University of Poitiers

It should be noted that some of the above organisations, especially the university networks, have also shared key position papers both on the future revitalised ERA Communication and on the Universities of the Future in Europe.

Provision of success cases/ good practice case studies

- OPEN-AIRE
- European Consortium of Innovative Universities (ECIU)
- University of Ljubljana
- University of Ghent - example of a knowledge brokerage scheme which operates not only at the University of Ghent, but also across Flanders

Other stakeholders that took part in the stakeholder consultation process and events

- University rectors from the French Rectors Conference and the German Rectors Conference.
- Representatives from the trio of EU Presidencies from Germany, Slovenia and Portugal with a strong interest in the revitalised ERA Communication.

Other written contributions

- Commission official responsible for social innovation from DG GROW.

Workshop Participant List, 13th – 14th February 2020

Centre for Strategy & Evaluation Services

European Commission

Towards a 2030 Vision on the Future of Universities in Europe

First Workshop, 13th - 14th February 2020

Participants List

First Name	Surname	Organisation
Leonas	Balaševičius	Kaunas University of Technology
Mattias	Björnmalm	CESAER
David	Bohmert	CESAER
Michaela	Brady	CSES
Professor Jan	De Groof	College of Bruges and Tilburg University
Professor Kurt	Deketelaere	LERU / KU Leuven
Stijn	Delauré	European Commission, DG RTD
Tine	Delva	European Commission, DG EAC
Professor Lars	Engwall	Uppsala University
Professor Fulvio	Esposito	Ministry of University and Research, Italy
Jean-Emmanuel	Faure	European Commission, DG RTD
Victoria	Galan Muros	UIIN
Silvia	Gómez Recio	Young European Research Universities Network (YERUN)
Piet	Henderikx	European Association of Distance Teaching Universities (EADTU) / KU Leuven
Thomas	Jorgensen	European University Association (EUA)
Apostolia	Karamali	European Commission, DG RTD
Anna-Maria	Krarup	CSES
Marco	Masia	Senior Study Expert
Professor Eva	Méndez Rodríguez	Universidad Carlos III de Madrid
Veronica	Mobilo	European Commission, DG EAC
Conor	O'Carroll	Senior Study Expert
Gareth	O'Neil	Senior Panellist
Professor Jan	Palmowski	The Guild
James	Rampton	CSES

First Name	Surname	Organisation
Professor Marino	Regini	Department of Social and Political Sciences, University of Milan
Dr Sybille	Reichert	Reichert Consulting for Higher Education
Hugo	Sharp	European Commission, DG RTD
Emanuela	Sirtori	CSIL
Peter	van der Hijden	Senior Study Expert
Professor Marijk	van der Wende	Senior Study Expert
Professor Bert	van der Zwaan	Utrecht University
Professor Frans	van Vught	High level Expert / University of Twente
Karen	Vandevelde	Senior Panellist
Carolina	Vigo	Business Europe
Stefan	Weiers	European Commission, DG RTD
Thomas	Weko	OECD
Mark	Whittle	CSES

Workshop Participant List, 4th March 2020

Centre for Strategy & Evaluation Services

European Commission

Towards a 2030 Vision on the Future of Universities in Europe

Workshop, 4th March 2020, 10h00-17h00

Venue: Hotel NH Brussels Bloom, Rue Royale - Koningsstraat, 250, 1210 Brussels

Participants List

First Name	Surname	Organisation
Anne	Adams	YERUN / University of Antwerp
Rasmus	Antoft	Aalborg University
Odile	Arbeit de Chalendar	Université Gustave Eiffel
Dra. Eva	Arrilucea Solachi	Tecnalia / EARTO
Zorana	Barišić	Permanent Representation of Croatia to the EU
Martin	Bogdan	Academic Cooperation Association (ACA)
Michaela	Brady	CSES
Prof. Dr. Barbara	Buchenau	Universität Duisburg-Essen
Meritxell	Chaves	CHARM European University
Nik	Claesen	European Association of Research Managers and Administrators (EARMA)
Anna-Lena	Claeys-Kulik	European University Association (EUA)
Chiara	Colella	YERUN
Stijn	Delauré	European Commission, DG RTD
David Brian	DeVallance	InnoRenew CoE / University of Primorska
Linden	Farrer	European Commission, DG Research and Innovation
Klara	Ferdova	SEFI - European Society for Engineering Education
Jean-Emmanuel	Faure	European Commission, DG Research and Innovation
Eric	Foucher	CPU – Conférence Présidents Université
Prof. Bernard	Fügenschuh	Universität Innsbruck
Dr Sacha	Garben	Legal Studies Department of the College of Europe

First Name	Surname	Organisation
Christian	Gerhardts	European Project Centre (EPC), TU Dresden / CESAER
Åse	Gornitzka	University of Oslo
Prof. Piet	Henderikx	European Association of Distance Teaching Universities (EADTU) / KU Leuven
Luisa	Henriques	Permanent representation of Portugal to the EU
Dr. Tuija	Hirvikoski	Laurea University of Applied Sciences / ENoLL council
Eva	Hoogland	TU Delft / CESAER
Apostolia	Karamali	European Commission, DG RTD
Laura	Keustermans	LERU / KU Leuven
Magnus	Klofsten	Centre for Innovation and Entrepreneurship (CIE) at Linköping University.
Dr. Mojca	Kotar	OpenAIRE (Open Access Infrastructure for Research in Europe) / University of Ljubljana
Cornelis	Kouwenaar	Aurora Universities Network
Anna-Maria	Krarup	CSES
Jörg	Langwaldt	European Consortium of Innovative Universities (ECIU) / Tampere University
Prof. Gabi	Lombardo	European Alliance for the Social Sciences and the Humanities (EASSH)
Alexandru	Marchis	Universities Informal Liaison Offices Network - UnILiON
Marco	Masia	Senior Study Expert
Prof. Liviu	Matei	Central European University
Emmanuelle	Merlin	Permanent representation of France to the EU
Prof. Reine	Meylaerts	LERU / KU Leuven
Marija	Mitić	Academic Cooperation Association (ACA)
Sergej	Mozina	Permanent Representation of the Republic of Slovenia to the EU
Conor	O'Carroll	Senior Study Expert
Prof. Joe	O'Hara	European Educational Research Association (EERA)
Gareth	O'Neil	Senior Expert Panellist
Professor Jan	Palmowski	The Guild of European Research Intensive Universities
Tatiana	Panteli	EuroTech Universities Alliance
Patricia	Postigo McLaughlin	European Commission, DG Research & Innovation

First Name	Surname	Organisation
Vanessa	Proudman	SPARC Europe
James	Rampton	Project Manager, CSES
Prof. Bernard	Rentier	Université de Liège / European University Association (EUA)
Patrick	Reurnik	Norwegian University of Science and Technology (NTNU)
Dorte	Riemenschneider	European Citizen Science Association (ECSA)
Julien	Roche	LIBER
Felix	Ruix Cabré	Maastricht University / YERUN Member
Ann	Schillemans	LERU / KU Leuven
Wendy	Sonneveld	Ghent University / CESAER
Robin	Stevens	EURASHE / University College Ghent
Prof. Ludovic	Thilly	Coimbra Group
Peter	van der Hijden	Senior Study Expert
Professor Marijk	van der Wende	Senior Study Expert
Karen	Vandevelde	Senior Expert Panellist
Carolina	Vigo	Business Europe
Michael	Vorländer	Permanent Representation of the Federal Republic of Germany to the European Union
Jana	Weidemann	Norwegian Ministry of Education and Research
Mark	Whittle	Team leader, CSES
Sarika	Wilson	The Guild of European Research Intensive Universities
Nils	Wörner	CPU – Conférence Présidents Université
Dr. J. Leslie	Zachariah-Wolff	The IDEA League

Annex 3 – Cross-check of ERAC priorities for the revitalised ERA with the TMs

The publication of the ERAC Opinion on the Future of the ERA provided a useful input to the development of the revitalised ERA. In its working paper, the ERAC identified four main priority areas to be addressed by the revitalised ERA. These are as follows:

1. Framework conditions for the production, circulation and use of knowledge, including researcher career issues;
2. R&I driven joint action with other policy areas;
3. Relevance and visibility of R&I for society; and
4. The broad topic of inclusiveness.

It should be stressed that whilst the ERAC priorities are useful, they relate to the revitalised ERA overall, and not only to the future of universities. Nonetheless, the views of the European Research Area and Innovation Committee (ERAC) were taken into account in developing the Vision for the future of universities and transformation modules.

At the second workshop, participants from the university sector advocated reviewing the recommendations made by ERAC in relation to the high-level priorities suggested for the ERA, and in particular, the specific priorities identified by the ERAC in its working paper on the Draft ERAC Opinion on the Future of the ERA[389]. The purpose was to check that these are considered and where possible aligned with the development of the Vision and in the definition of the transformation modules.

The table below lists the full titles of the proposed transformation modules. It also identifies how the ERAC priorities identified by the ERAC Working Group for the future ERA have been considered in the definition of the cross-cutting and thematic modules. In addition to the above-mentioned strategic priorities, the ERAC offered several more concrete recommendations relevant to the Vision articulated in this policy report. These are also reflected in the table below, where relevant.

Table 6-1 - Transformation modules and cross-check of links with the ERAC priorities identified by the Member States.

Transformation modules	Links with the ERAC priorities identified for a revitalised ERA
• TM1: Governance issues for the 2030 Vision, and legal framework for university cooperation in research and innovation.	• **(1) Framework conditions for the production, circulation and use of knowledge, including research career issues.** The ERAC recommends exploring ways to increase the interoperability of national and EU R&I systems to reduce the fragmentation of rules and procedures for R&I funding.
• TM2: Maintaining trust and research integrity.	• **(3) Relevance and visibility of R&I for society**. This includes involving stakeholders and citizens (including vulnerable populations) in setting R&I policy priorities and in knowledge-creation processes as well as fostering awareness of the societal benefits of R&I.
• TM3 - A strategic European Research and Innovation agenda: the central role of universities as research actors.	• **(2) R&I driven joint action with other policy areas**. The ERAC's view is that synchronised investments and implementation mechanisms require a holistic dimension and should therefore be established based on co-design and co-

[389] Council of the European Union. (2019). Draft ERAC Opinion on the Future of the ERA. (WK 13883/2019 INIT). Brussels.

Transformation modules	Links with the ERAC priorities identified for a revitalised ERA
	implementation with other European policy areas. In addition, the ERAC notes that these joint initiatives should also include a joint strategic approach for international cooperation and meeting SDGs. • **(4) Broad Inclusiveness.** This includes the facilitation of collaborative links and brain circulation.
• TM4: Strengthening human capital and working conditions in universities.	• **(1) Framework conditions for the production, circulation and use of knowledge, including research career issues**. The ERAC notes the need focus on enhancing research career interoperability and rewarding systems, including gender and minority considerations when assessing career opportunities. • **(4) Broad Inclusiveness.** This includes the facilitation of collaborative links and brain circulation.
• TM5: Fostering co-operation between academia and non-academic sectors.	• **(3) Relevance and visibility of R&I for society**. This includes involving stakeholders and citizens (including vulnerable populations) in setting R&I policy priorities and in knowledge-creation processes as well as fostering awareness of the societal benefits of R&I. • **(4) Broad Inclusiveness.** The ERAC notes that the revitalised ERA's actions should facilitate collaborative links between researchers, institutions, and citizens, encompassing the geographical dimension, human capital, gender, and minority groups-related issues, as well as both public and private institutions in all sectors.
• TM6: Knowledge- and digitally-driven universities – the transition to open science (through FAIR and open data), open access and open education.	• **(1) Framework conditions for the production, circulation and use of knowledge, including research career issues.** This includes further developing Open Science and Open Innovation policy approaches at European and national levels in order to foster the circulation of knowledge.
• TM7: Optimising universities' role in research infrastructures.	• **(2) R&I driven joint action with other policy areas**. The ERAC notes that the ERA should seek to promote cooperation among MSs on specific topics (particularly through R&I infrastructures and European partnerships).

Annex 4 - Additional case studies and success stories

The following case study illustration relates to the role of the COVID-19 pandemic and this demonstrates the importance of further strengthening the crisis mechanism at EU level to address urgent societal research needs, such as addressing global health challenges:

Strengthening the crisis mechanism to address urgent societal challenges

Case study title: Strengthening the crisis mechanism to address urgent societal challenges

Problem definition: A key challenge for EU research and innovation policy makers and funders is in strengthening the efficacy and timeliness of the crisis mechanism to be able to respond to global health crises, such as the current COVID-19 pandemic and earlier crises such as Ebola and Zika. to deliver research outcomes.

More positively, there has already been an enormous mobilisation of EU and national funds for solutions to address many aspects of the crisis. Similar research activities were supported and deployed for Ebola and Zika in the previous 5 years.

Under conventional programming approaches, such as Horizon 2020, there is a time lag between initial consultation through programme committees consisting of Member State representatives, through to the publication of the call for proposals by topic, the selection of research projects and then three years of research activities is added together, it may take five years between demand for research support in a particular EU policy area, of type of societal challenge being identified and the final research results being available. This may be much too late from an end-user [390] perspective.

Benefits of an interdisciplinary approach to research into the impacts of COVID-19 and interlinkages with other SCs: The unprecedented situation in Europe due to lockdowns has meant greatly accelerated take up of digitalisation, and experimentation with new forms of work organisation, such as increased homeworking by academic staff and researchers, and greater use of video conferencing to conduct meetings and research. Developments such as the pandemic may also have unintended consequences on other societal challenges. For instance, an indirect consequence of health-related lockdowns across many European countries has meant a significant reduction in carbon emissions and air pollution levels, but the current lockdowns are economically unsustainable. Therefore, research is needed into how to capitalise on some of the unexpected consequences. The inter-play between different societal challenges – including unexpected impacts – could therefore be considered by universities when developing their research agendas. This will require increasingly interdisciplinary approaches, as for instance, developing an understanding of particular issues such as whether the increase in home-working will lead to permanent or temporary changes in work patterns, and investigating the attendant environmental effects, could be investigated. A number of disciplines would be relevant e.g. health research, environmental research and SSH.

Imperative of delivering timely research results: whilst the existing FPs could deliver useful research results to address global health challenges, they could not easily and flexibly deliver relevant research and operational solutions within weeks or months, which is what is evidently needed, except through the use of existing funding sub-programmes, and the development of calls for proposals at short notice to tackle the pandemic. [391] The setting-up of more sustainable funding instruments to address the most pressing societal challenges could perhaps be considered to ensure that research results can be delivered to end users, tested and deployed more rapidly in a real-life setting.

Implications for universities in conducting research post-COVID-19: there could be many impacts, including unforeseen consequences. Examples are: restrictions on freedom of movement of researchers, virtual data collection methods and greater use of digitalisation in research processes.

A number of dedicated EU funding calls through the FPs relating to COVID-19 have been published.

[390] Examples of end-users will vary by thematic area but include, for instance: EU policy makers, national governments and authorities, international governments, NGOs and civil society organisations, public authorities with specific responsibilities, such as crisis management and emergency response, border control agencies as well as private sector industry stakeholders.
[391] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/covid-19

[392] These have provided an immediate means of funding research into COVID-19.

Lessons learned: Whilst the crisis mechanism provides an accelerated mechanism for conducting especially urgent research, this needs to be strengthened. Looking ahead, it would be better to have flexible research project funding instruments to commission competitive research projects of shorter duration (e.g. perhaps a duration of 6-12 months) more permanently to address pressing societal challenges and needs.

The final example describes some of the characteristics of the Top 100 European Universities. Many of these institutions are characterised by their strong R&I performance, commitment to achieving continued scientific and research excellence and by good institutional governance. The aim is to show how good governance can help to drive improvements in universities' performance. If more universities across Europe were to adopt some of the practices of the leading universities, then this would lift a higher number of universities towards the goal of achieving excellent science and being able to access highly-competitive EU and national research funding.

However, this is not to suggest that ranking systems are the way forward, as many stakeholders identified limitations in such ranking systems, which may favour universities with higher income over quality and contribution to excellent science. Rather, the point is that there are some features of these universities, especially in terms of their performance in driving excellent science, that more universities across Europe should aspire to. This reflects the broader concept of lifting the boats to create more winners, which was discussed at the two stakeholder workshops and also at the validation seminar.

Reforming institutional governance in universities by strengthening inter-University cooperation at European level

European top 100 universities

Project implementer: Universities and governments in nine European countries. See list in Annex 3: European top 100 universities list

Programme funding and duration: These universities enjoy public investment at high levels for decades, allowing them to perform well in R&I, attract private investment and successfully compete in national and European funding schemes, notably the EU framework programmes and the current Horizon 2020.

Objectives: Excellence in R&I, high quality teaching and better service to society.

Description of activities: These universities carry out their missions enjoying a relatively high degree of autonomy. Several of the high-flyers are the result of deliberate **pooling & merger policies** and **excellence initiatives** decided and supported by public authorities. The two highly successful Swiss Federal Institutes, of Zurich and Lausanne, are set up under a federal statute with more autonomy and more funding.

Key achievements / lessons learned: High levels of funding and autonomy foster performance. Europe has some 30% of the world's top 100 universities (ARWU, THE and QS rankings combined). Around half of these are located in the UK and Switzerland (outside the EU!) and are relatively more often found in top 50 strong positions in EU: NL, Sweden. Rising in EU: Germany and France.

Replicability / transferability potential: The performance of universities in Europe would be further enhanced if governments were to decide to increase funding and autonomy for universities in general and for selected top performers in particular.

Sources of further information:

- ARWU, THE and QS rankings.
- The EUA Autonomy Scorecard

[392] European Commission. (2020). *European Research Area (ERA) Corona Platform*. Available at: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/covid-19

Reforming institutional governance in universities by strengthening inter-University cooperation at European level

University consortia

Project implementer: Universities consortia engaged in structural inter-university cooperation at European level using legal cooperation vehicles such as the Knowledge and Innovation Communities (KICs) of the European Institute of Technology (EIT), European Research Infrastructure Consortia (ERIC), European Groupings of Territorial Cooperation (EGTS) and European University Alliances Partnership Agreements (under the European University Initiative/EUI).

Programme funding and duration: Most of these consortia are long-term (more than ten years). They are co-funded by European programmes such as Horizon and Erasmus+.

Objectives: Excellence in R&I, high quality teaching and better service to society.

Description of activities: These consortia integrate core activities of their missions to enhance their performances. They may include non-academic partners;

Key achievements/lessons learned: These consortia have increased the frequency and intensity of inter-university cooperation in Europe. They have also increased complexity. Regular monitoring and evaluation of such cooperation between universities – including the longitudinal dimension to demonstrate impacts over time – could strengthen understanding about the benefits and potential impacts of such cooperation among a broader cohort of universities in Europe.

Replicability/transferability potential: Approaches are replicable and transferable if it can be demonstrated that, in due course, inter-university cooperation will enhance performance well beyond the costs of cooperation and cooperation support. Impact studies exist for the EIT-KICs, ERIC and EGTS. European University Alliances have only just started their pilot phase.[393]

Sources of further information:

- EIT - https://eit.europa.eu
- ERIC - https://ec.europa.eu/info/research-and-innovation/strategy/european-research-infrastructures/eric_en
- EGTC - https://www.eucor-uni.org/en/about-us/organisation-of-the-alliance
- **European Universities Initiative:** https://ec.europa.eu/education/education-in-the-eu/european-education-area/european-universities-initiative_en

[393] EIT. (2017). *EIT: Our Impact from 2010 to 2016*. Available at: https://eit.europa.eu/sites/default/files/11983-eit-2017_our_impact_from_2010_to_2016.pdf

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In the context of the revitalised ERA Communication, this study sets out a stakeholder-driven, strategic Vision 2030 for the future of universities in Europe in research and innovation. Recognising Europe's diverse university landscape, the study considers the extent to which – and how - universities' ongoing transformations might best be supported through EU support (e.g. policy changes, funding, legal mechanisms). The Vision is underpinned by European values, such as respecting institutional autonomy and academic freedom, scientific and research excellence by exploiting universities' investments in fundamental research, delivery societally-relevant research, maintaining trust, equality of opportunity and inclusivity, and openness based on reciprocity from third countries (e.g. through open science, open access and open data approaches in which Europe excels).

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