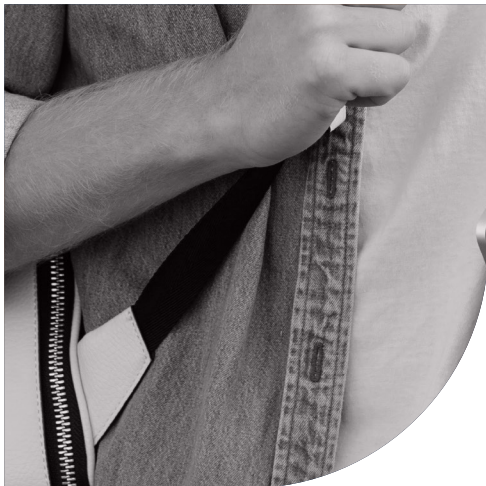


European
Commission



RESEARCHERS'

SKILLS

Analysis of progress made in projects funded
under Horizon 2020 and Horizon Europe,
including the European University Alliances



Written by Chiara Biglia and Attila Pausits
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European Research Executive Agency (REA)
Unit C.4 - Reforming European R&I and Research Infrastructures
E-mail: REA-HE-ERA@ec.europa.eu

European Commission
1049 Brussels
BELGIUM

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Foreword

It is my pleasure to introduce this report on researchers' skills, which provides intermediate progress reported in 16 skills-related projects and in the [European University Alliances](#) (hereafter alliances) and research management projects funded under Horizon 2020 and Horizon Europe.

The new [European Skills Agenda](#) and the European Commission Communication on a [renewed EU Agenda for Higher Education](#), including also the [EU's Open Science Policy](#), made it crucial for higher education institutions, including the alliances, to integrate new or existing open science, open innovation and entrepreneurship skills courses into PhD programmes. The funded skills-related projects triggered the development of a broad package of skills-related training for researchers and scientists in all career stages, with a focus on open science and open innovation practices.

The European Research Executive Agency (REA) is entrusted by the Commission with the management of significant parts of the EU Research and Innovation (R&I) framework programmes. An important part of our work is to provide policy feedback to the Commission and EU citizens, based on our contacts with beneficiaries whose opinions on our actions we value and treasure. Therefore, we put great emphasis on lessons learned from projects, in terms of what works well and what needs improvement. This contributes to improving the design and development of the future R&I policy and actions under the framework programme, inspiring transformations at the institutional, national and European levels.

This report was drafted by a team of independent experts and is based on the analysis of project outputs and deliverables, including the policy briefs delivered by the consortia involved. The approach has been to identify good practices and aspects that require additional efforts and improvement.

With this report, we are proud to provide policy feedback and initial evidence on the implementation of the [European Research Area](#) (ERA) policy agenda, in particular [ERA Action 4](#) – Promote attractive research careers, talent circulation and mobility, and [ERA Action 17](#) – Enhance public research institutions' strategic capacity. The report presents the tangible progress made, highlights the main challenges encountered and showcases noteworthy practices.

The recommendations provided by the experts are of particular significance and we acknowledge the need for future work on this field.

Marc Tachelet
Director
European Research Executive Agency

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This report was written by Chiara Biglia, Head of Career Center Division at the Politecnico di Torino, and Attila Pausits, Head of Department for Higher Education Research at the University for Continuing Education Krems.

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Introduction

This report addresses researcher skills, as part of a series of three feedback to policy reports, that take stock of the progress and promising practices generated by a selection of EU-funded projects on skills, research assessment reform and the R&I activities of the Horizon 2020 'Science with and for Society' (SWAFS) projects supporting the alliances.

This report is the first to capture contributions of EU-funded projects on skills development since the launch of the [European competence framework for researchers](#) (ResearchComp) website in 2023. It gives an overview of the progress achieved so far, on the basis of emerging and interim activities and outputs. However, it only includes the early-stage developments; further activities, outputs and outcomes in the area are likely to develop at a fast pace in the coming years.

The Commission has emphasised the need for upskilling researchers and research managers to foster a competitive and resilient ERA. This involves equipping researchers with transversal skills necessary for their careers, both within and outside academia, thus enhancing mobility and career prospects.

The goals of this report are to:

- give a broad overview of the efforts made to support skills development within the European R&I landscape, also analysing the need for further work in the area;
- map skills activities that are tested, developed and implemented through EU-funded projects;
- support the dissemination of good practices stemming from the analysed EU-funded projects and explore how they contribute to the implementation of [ResearchComp](#);
- share the results with the Commission, EU Member States, research-funding organisations, research-performing organisations, universities and other interested stakeholders;
- present skills-related recommendations to support the attainment of the recommendations enshrined in the Council recommendation establishing a [European framework for research careers](#).

In this report, 16 Horizon 2020 and Horizon Europe projects are analysed, highlighting their main objectives, methodologies and outcomes. These projects focus on developing researcher skills, including open science, entrepreneurship and innovation, and aim to create more dynamic and interoperable research careers. The report also reflects skills development in the context of the progress of alliance projects funded under the SWAFS programme of Horizon 2020, focusing notably on the area of human capital. Furthermore, insight is collected from research management projects funded under Horizon Europe.

Executive summary

This report provides a comprehensive analysis of the initiatives and projects funded under Horizon 2020 and Horizon Europe linked to [Action 4](#) and [Action 17](#) of the ERA policy agenda. These actions are pivotal in enhancing the skills of researchers and research managers across Europe, thereby strengthening the overall European R&I ecosystem.

The report reviews 16 projects, showcasing their goals, methods and results, with a focus on skills such as open science, entrepreneurship and innovation, to foster a flexible research workforce. It also examines skill development within the alliances, which play a key role in piloting frameworks for research careers and competencies, emphasising the enhancement of human capital in R&I.

Furthermore, the role of research managers has gained prominence in the last years, with initiatives aimed at enhancing their skills and the related professional rewarding and recognition.

Recommendations in this report advocate for the use of ResearchComp to centralise and link dedicated skills training courses to competencies and proficiency levels, fostering skills development and recognition for researchers at all career stages. Recommendations also address the promotion of the integration and connection between ResearchComp and the upcoming research managers' competence framework. The aim is to share methodologies, support cross-disciplinary and cross-sectoral collaboration, and validate, formalise and value researchers' and research managers' skills.

1. Policy context

Researchers are at the core of the ERA, which was launched in 2000 and revitalised in September 2020 with the Commission communication on [a new ERA for R&I](#). A comprehensive approach is needed to attract and retain talents, including by implementing a toolbox of measures aimed at recognising the profession and skills of researchers inside and outside academia.

Researchers are among the most-skilled workers in Europe, and upskilling and enhancing their abilities and knowledge will make Europe stronger and more competitive. The [European Skills Agenda for sustainable competitiveness, social fairness and resilience](#) (July 2020) called for a paradigm shift on skills and referred to a specific set of core research and transversal skills necessary for successful careers in and outside academia, fostering increased mobility of researchers.

The Council conclusions on '[Deepening the European research area: Providing researchers with attractive and sustainable careers and working conditions and making brain circulation a reality](#)' (May 2021) marked a breakthrough in the objective of increasing the attractiveness of research careers and called on Member States and the Commission to improve skills and training for early-career researchers to boost recruitment and career progression.

Promoting attractive and sustainable research careers is also the objective most pursued by Member States in the [ERA Policy Agenda 2022–2024](#), which implements concrete measures in the priority areas set out in the [Council recommendation on a pact for R&I in Europe](#) (November 2021). Action 4 of the ERA policy agenda foresees the development of a European framework for research careers and the creation or improvement of existing tools to support research careers.

In line with these objectives, in December 2023 the Council adopted the [recommendation on a European framework to attract and retain research, innovation and entrepreneurial talents in Europe](#). This recommendation includes in annex the new European charter for researchers, and it fosters the use of ResearchComp to support researchers' transversal skills, enabling seamless mobility between sectors and research disciplines.

1.1. Strengthening researchers' skills

European policy addresses the importance of equipping researchers, and in particular early-career researchers, with the skills needed for alternative careers outside academia or to start entrepreneurial activities, fostering more career opportunities, including in the private sector. Findings in the 2022 report [Knowledge Ecosystems in the New ERA – Using a competence-based approach for career development in academia and beyond](#) show that PhD candidates do not receive a satisfactory level of training in transversal skills during their doctoral programmes. Skills that prepare them for inter-sectoral mobility can contribute to strengthen research careers and make them more attractive, including by opening opportunities in other sectors and countering the precarity that affects many early-career researchers, who usually hold fixed-term positions funded through grants with no prospect of permanent or continuous

employment. For these reasons, special attention is paid in this report to doctoral and postdoctoral researchers (R1 and R2 levels), as most of them will certainly not get permanent employment in the academic sector.

From the point of view of developing researchers' skills for multiple careers, several highly relevant initiatives are ongoing within the EU.

The development of ResearchComp is part of one of the flagship actions of the already mentioned [European Skills Agenda](#), which supports the development of transversal skills, a taxonomy of researchers' skills and related training.

On this basis, the Commission developed a taxonomy of transversal skills for researchers which resulted in the update of the [European Skills, Competences, Qualifications and Occupations](#) (ESCO) classification, which now offers a 'common skills language' for researchers that can be generically used by all interested stakeholders, such as employers and education and training institutes.

The ESCO update with researcher skills was followed by the development of ResearchComp, which includes:

- 7 competence areas (cognitive abilities, doing research, managing research, managing research tools, making an impact, working with others, self management);
- 38 transversal researcher competences, including 389 learning outcomes;
- 4 proficiency levels for each competence (foundational, intermediate, advanced, expert).

ResearchComp will serve multiple purposes, including a better understanding and recognition of researchers' transversal skills by employers, and researcher self-assessments in order to fill competency gaps where necessary. In addition, ResearchComp will act as a blueprint for university training programmes.

Ongoing initiatives towards the reform of researchers' career assessment, such as the [Agreement on Reforming Research Assessment](#) published in July 2022, encourage the use of ResearchComp to assess competencies relevant to a respective role.

Despite the progress being made through the aforementioned agreement, improvements in the recognition of transversal skills in researchers' assessment are needed to truly encourage interdisciplinary research and the transition of researchers into broader employment sectors outside academia or towards the creation of own start-ups and innovation. A key barrier to progress in this regard is the current limited approach to evaluating researchers, primarily relying on peer-reviewed publications and often the narrow metric of the journal impact factor. This limitation results in researchers having low motivation to participate in activities such as open science, cross-sectoral mobility, entrepreneurship, citizen science and outreach, as these activities are perceived as unlikely to contribute to academic career advancement.

There are more instruments, equally supported by the Council recommendation adopted in December 2023, such as the **research and innovation careers observatory** – foreseen by

Action 4 of the ERA policy agenda to monitor the implementation of measures to strengthen research careers – and the **ERA talent platform** as a comprehensive one-stop shop for researchers, institutions and the wider spectrum of R&I stakeholders. The platform will constitute the access point to – among others – the evolution of the [Euraxess](#) services network and affiliated websites, to facilitate researchers' mobility and scientific collaboration through free personalised assistance and career development support.

In 2020, a new 'Career development' section was added to the main Euraxess website, which provides a range of resources for both individual researchers and their employers and funders, including training materials and links to online webinars. Moreover, career development was added to the portfolio of support centres for researchers, and mentoring and coaching sessions can be provided based on a tailored approach. Over the years, additional instruments have played an important role in supporting the careers and employability of researchers through the improvement of skills, and have the special merit of having enabled support for career development in national contexts that have so far not provided incentives in this direction.

This is certainly the case with instruments that have existed for a long time, such as the [Marie Skłodowska-Curie Actions](#) (MSCA) and the [Human Resources Strategy for Researchers](#) (HRS4R). The **MSCA** play a vital role in fostering the skills of early-career researchers. By promoting international mobility, interdisciplinary research and industry–academia partnerships, the MSCA ensure that PhD candidates and postdoctoral researchers gain diverse experiences that enhance their training. Under the MSCA, the 'Doctoral networks' foster collaborations between academic institutions and industries. By doing so, they ensure that PhD candidates receive a blend of academic and practical training, making them better prepared for both academic and non-academic career trajectories. The **HRS4R** has so far enabled more than 700 institutions to implement the principles of the European charter for researchers (formerly charter and code for researchers), including those relating to open, transparent and merit-based recruitment, and support actions for continuous improvement of researchers' skills, employability and working conditions. According to the study [Taking stock, evaluating the achievements and identifying the way forward for the ERA priority 3 policy measures](#) published in December 2021, HRS4R action plans feature a diversity of activities, including training in professional skills or research-related skills for researchers, training for supervisors or human resources managers, information and training for new researchers.

Building upon **Horizon 2020, Horizon Europe** also emphasises the importance of equipping researchers with both technical and transversal skills. Specific calls and funding opportunities target early-career researchers, ensuring they have the resources they need to excel.

Among the **transversal skills**, many calls and training have focused on **open science, open innovation and entrepreneurship**. The EU recognises the paradigm shift towards more collaborative and transparent research methodologies. Open science policies aim to make scientific processes and results more accessible. Early-career researchers are encouraged to embrace open innovation, collaborating beyond traditional academic boundaries and translating research into marketable solutions. Entrepreneurship is fostered, ensuring that researchers not only contribute to academia but also drive economic growth. Initiatives like the European Institute of Innovation & Technology support entrepreneurial researchers, bridging the gap between their innovative projects and the market.

1.2. European University Alliances

Contributing to the ERA in an integrated approach with the European education area was the key objective of the call 'Support for the Research and Innovation Dimension of European Universities' under the Horizon 2020 SWAFS ([IBA-SwafS-Support-1-2020](#) and [IBA-SwafS-Support-2-2020](#)). European universities are used as testbeds for exploring support for institutional transformation in their R&I dimension and implement seamless and effective content synergies between Erasmus+ and Horizon 2020.

One of the transformation modules proposed in Horizon 2020 aimed at developing and implementing strategies for strengthening human capital in R&I and enabling balanced brain circulation. In this regard, it called for the development of activities aimed at equipping researchers with a combination of **pedagogical skills, future-oriented skills, open science skills, research integrity, interdisciplinarity and entrepreneurial skills**, along with the active promotion of re- and up-skilling through lifelong learning.

The alliances are expected to pilot the recommendations of the December 2023 Council recommendation, including as regards the implementation of ResearchComp.

1.3. Supporting research managers

Over the past few decades, the ERA has experienced rapid growth, characterised by a wealth of opportunities in research funding, transnational cooperation, networking and mobility. This expansion has fostered a vibrant and highly competitive landscape. Consequently, there has been a **growing need for human resources specialised in science, technology and innovation management**. Additionally, there is an increased demand for professionals in the communication and dissemination of science, and in science policy and the evaluation of scientific, technological and higher education systems.

Recent actions within the ERA have been geared towards capacity developments. This includes the Council recommendation on a European framework for research careers (ERA Action 4), and policy development under ERA Action 17 (the research management initiative) to strengthen strategic capacity of public research-performing organisations. The availability of efficient research management and support capacity enables researchers to concentrate more effectively on their primary research tasks. The Council put an increased emphasis on **developing research management capacities**, particularly by strengthening the role, upskilling, networking and profession of research managers. As underscored in the [pact for R&I](#), the role of research managers in preserving institutional and policy knowledge, along with ensuring the continuity of expertise, is vital for the success and effectiveness of the ERA.

1.4. Relevant ERA Actions

The ERA policy agenda is critical in contextualising the policy framework for researchers' skills in the EU. ERA Actions 4 and 17 are especially significant in this context. ERA **Action 4 – 'Promote attractive and sustainable research careers, balanced talent circulation and international, transdisciplinary and intersectoral mobility across the ERA'** emphasises

the attractiveness and sustainability of research careers in the EU. Central to this is the support for early-career researchers, ensuring they have access to viable and robust career paths. The action promotes **transparent recruitment processes and clear career progression paths**. This clarity aids early-stage researchers in understanding potential opportunities. Further to this, by emphasising gender balance and promoting opportunities for under-represented groups, ERA Action 4 **ensures a diverse research ecosystem**. A key component is the support for **cross-border mobility of researchers**, enabling them to gather a wider range of experiences. Training and development opportunities, especially for early-career researchers, are integral to this action.

The EU's multifaceted policy approach showcases its commitment to nurturing a generation of researchers equipped for both contemporary challenges and future advancements. By integrating skills such as open science, open innovation and entrepreneurship into the core of researcher training, the EU positions itself at the forefront of global R&I. The EU's policy framework delineates the significance of nurturing early-career researchers, ensuring they have the skills, resources and opportunities to flourish. The focus on standardising and enhancing PhD programmes, coupled with initiatives that foster mobility and collaboration, showcases the EU's commitment to cultivating a new generation of skilled and adaptive researchers.

Strengthening the capacity of research management is at the heart of ERA Action 17. Member States, stakeholders and the Commission are developing policy actions and programme instruments in support of better recognition of the research management profession, more and better accessible upskilling tools, national research management communities for easier practice exchange, and better research management capacity in organisations that have a lower R&I intensity. The added value of a strong and efficient research management capacity for the quality and impact of the R&I system cannot be underestimated. Success stories are being collected, and a quantitative analysis on the impact is being conducted.

2. Skills-related project portfolio and analysis

2.1. Project portfolio

The Commission launched five calls for proposals under Horizon 2020 and Horizon Europe with the aim to strengthen and recognise the skills of researchers from different angles. This report provides an analysis of the main features and progress of the resulting 16 funded projects.

- Topic 8, [Research innovation needs and skills training in PhD programmes](#) of the call H2020-SwafS-2018-2020, aimed to develop a comprehensive training programme focusing on open science and entrepreneurship skills for researchers and scientists at all career stages. The call aligned with the new European skills agenda and the renewed EU agenda for higher education, emphasising the need to integrate open science and entrepreneurship skills courses into PhD programmes and to train data stewards. The formal integration of skills courses developed in collaboration with non-academic stakeholders into curricula was highlighted as a specific challenge.
- Topic 50, [Developing an effective ERA talent pipeline](#) of the call HORIZON-WIDERA-2022-ERA-01, aimed to support the establishment of an enhanced EU framework for researchers' careers towards a pipeline of highly skilled, creative and resilient talents to match the demand of society and the economy, thus accelerating the achievement of a knowledge-based society and economy.
- Topic 31, [Bottom-up approach to build SWAFS knowledge base](#) of the call H2020-SwafS-2018–2020, focused on societal interactions with science, emphasising open science and open innovation.
- Topic 01, [Supporting an EOSC-ready digitally skilled workforce](#) of the call HORIZON-INFRA-2021-EOSC-01, aimed to enhance open science by developing skilled professionals, improving research practices and contributing to the Horizon Europe [European Open Science Cloud](#) (EOSC) Partnership. It focused on creating support materials, curricula and learning pathways for researchers, data curators and policymakers.
- The [ERA talent platform](#), under the call HORIZON-WIDERA-2022-ERA-IBA, aimed at expanding the Euraxess services network and affiliated websites, to facilitate researchers' mobility and scientific collaboration. As a comprehensive one-stop shop of services, portals and tools, the platform has a focus on talented researchers and institutions, and supports new career trajectories in academia, industry and business.

Table 1: Projects analysed, including the corresponding call for proposals

H2020-SwafS-08-2020 – Research innovation needs and skills training in PhD programmes		
<p><u>Chameleons</u> Championing a multi-sectoral education and learning experience to open new pathways for doctoral students</p>	<p><u>ENABLECARES</u> Enabling careers: priming talent for success in biomedicine</p>	<p><u>ProdPhD</u> Social network tools and procedures for developing entrepreneurial skills in PhD programmes</p>
<p><u>DIOSI</u> Developing and implementing hands-on training on open science and open innovation for early-career researchers</p>	<p><u>InnEO Space PhD</u> Open science innovation in PhD programme through earth observation: towards new career skills development</p>	<p><u>SKIES</u> Skilled, innovative and entrepreneurial scientists</p>
<p><u>DISCOVERY LEARNING</u> Effective training of transferable skills related to open science and innovation for PhD candidates and early-stage researchers</p>	<p><u>ISPAS</u> Paths to successful innovations</p>	<p><u>VERSA</u> Video games for skills training</p>
<p><u>DocEnhance</u> Enhancing skills intelligence and integration into existing PhD programs by providing transferable skills training through an open online platform</p>	<p><u>OPENING DOORS</u> Opportunities and education in networked innovation for new graduates with PhDs using open online resources</p>	

<p>HORIZON-WIDERA-2021-ERA-01-50 – Developing an effective ERA talent pipeline</p> <p><u>DocTalent4EU</u> Transforming Europe Through doctoral talent and skills recognition</p> <p><u>SECURE</u> Sustainable careers for researcher empowerment</p>	<p>HORIZON-WIDERA-2022-ERA-IBA – ERA talent platform</p> <p><u>ERA Talent</u> ERA Talent Platform for career development of researchers in Europe</p>
<p>H2020-SwafS-31-2020 – Bottom-up approach to build SWAFS knowledge base</p> <p><u>CRITICAL MAKING</u> Studying RRI principles in the maker community</p>	<p>HORIZON-INFRA-2021-EOSC-01-01 – Supporting an EOSC-ready digitally skilled workforce</p> <p><u>Skills4EOSC</u> Skills for the EOSC: Creating a training ecosystem for open and fair science</p>

2.2. Project analysis and main findings

A structured project analysis was conducted by identifying key issues addressed and covered through dedicated actions and outcomes outlined in the analysed projects. The framework of analysis consisted of the following six main dimensions: (1) target groups; (2) transversal skills; (3) methodology; (4) pilot implementation; (5) skills/course certification; and (6) knowledge sharing and impact assessment.

(1) Target groups

This dimension focuses on four researcher profiles, namely R1 to R4. The main target group of the projects analysed were first-stage researchers (R1), namely doctoral and postdoctoral researchers in the early stages of their new position, and recent PhD graduates who have embarked, or are about to embark, on a new career. Some projects offered resources for doctoral supervisors, who are expected to be able to guide and provide support across a diverse set of contexts.

OPENING DOORS has developed guidelines, educational videos, annotated bibliographies and other tools for supervisors to provide a clearer understanding of open science and the related required competencies. It is worth mentioning the [educational video for supervisors](#) developed by this project, which categorises the skills of open science to facilitate comprehension. The video was designed by asking a sample of supervisors about their understanding of open science, and the opinions of doctoral researchers recently educated in open science on what supervisors should know and teach about open science. The video supports supervisors in their efforts to establish a more in-depth understanding of open science for themselves and for the doctoral researchers.

SKIES conducted a local ecosystem analysis of significant importance and practicality, focusing on evaluating the needs of the local ecosystem and different target groups. The proposed approach for examining entrepreneurial aspects and assessing needs considers the partner from two perspectives.

- **Internal.** This involves assessing the present status of entrepreneurship education within higher education institutions. It revolves around the ability of these institutions to promote entrepreneurship and cultivate an entrepreneurial mindset among students.
- **External.** This aspect examines the role of higher education institutions within the wider entrepreneurial ecosystem, including their degree of engagement with other entities in the ecosystem, encompassing both the public and private sectors.

(2) Transversal skills

This dimension focuses on the transversal/transferable skills emphasised by projects, following the definition provided by the European Science Foundation in its 2009 forum report [Research Careers in Europe – Landscapes and horizons](#).

Several projects focused on open science and open innovation skills, and projects like **Chameleons**, **DocEnhance**, **InnEO Space_PhD**, **SKIES** and **DocTalent4EU** also included

other transversal skills training, for example in entrepreneurship, building a network, communication, negotiation, career management and supervising PhD candidates.

DISCOVERY LEARNING produced [skill ontology for open innovation and related career development cards](#), which identify essential skills for PhD graduates to effectively participate in innovation processes and make an impact through innovation, regardless of sector or type. The ontology includes 27 skills, each of which is described in career development cards with three levels of competency, instructions on how to develop them in and outside the academic context, and examples of specific career pathways for which the skill is highly relevant.

The ontology categorises the skills into two levels:

- core skills, which PhD candidates usually develop through regular academic training and which are essential for both innovation and traditional research;
- a second layer of skills, which requires additional training or experience with or from outside academia. Second-layer skills are organised in three stages of the innovation process: from idea to planning to implementation and impact.

(3) Methodology

This dimension focuses on how the skills needs are identified and which teaching and learning methods are developed and implemented, including dedicated training courses, on-the-job training, peer-to-peer learning, coaching and mentoring. Special attention was given to courses developed and delivered with stakeholders from outside academia.

Table 2: Framework of analysis with dimensions used

PROJECTS	MAIN TARGET GROUP				TRANSFERABLE SKILLS			METHODOLOGY	PILOT IMPLEMENTATION	SKILLS/ COURSES CERTIFICATION	KNOWLEDGE SHARING		IMPACT ASSESSMENT
	R1	R2	R3	R4	OPEN SCIENCE/ INNOVATION	ENTREP.	OTHER				Train-the trainers	Community of practice	
CHAMELEONS	✓						✓		✓	✓			✓
DIOSI	✓				✓	✓		✓	✓	✓	✓		✓
DISCOVERY LEARNING	✓				✓			✓	✓			✓	
Doc Enhance	✓				✓		✓		✓	✓			✓
ENABLECARES	✓				✓	✓		✓	✓	✓	✓		✓
InnEO Space_PhD	✓				✓	✓	✓	✓	✓	✓			
ISPAS	✓				✓	✓		✓	✓				
OPENING DOORS	✓				✓			✓	✓	✓		✓	
prodPhD	✓					✓		✓	✓	✓		✓	✓
SKIES	✓				✓	✓		✓	✓	✓	✓		
VERSA	✓						✓	✓	✓	✓			
CRITICAL MAKING					✓	✓	✓	✓	✓		✓	✓	
ERA TALENT	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	
DocTalent4EU	✓							✓	✓	✓			
SECURE	✓	✓	✓	✓			✓						
Skills4EOESC					✓		✓	✓		✓		✓	

In terms of methodologies, analysed projects incorporated various elements crucial for developing effective training courses, and used diverse methods for conducting training needs analyses. The methods used include the review of publications, policy and industry reports, EU project results, available local data, existing training offerings from participating higher education institutions, surveys of PhD and postdoctoral researchers, and the review and analysis of job advertisements in academic and business institutions.

DocEnhance and **DocTalent4EU** engaged with non-academic employers through interviews and surveys.

Chameleons and **OPENING DOORS** engaged in collaborative curriculum design exercises like 'World cafe workshops'.

ISPAS collected information on the transferable skills that PhD candidates consider important for their future career through a dedicated survey.

OPENING DOORS developed [guidelines for skills intelligence in open science and open innovation](#), outlining methods of analysis of highly qualified employees' skills required by employers active in open science and open innovation, to provide a basis for the design of an open online PhD course. One of the key features of the guidelines, which build upon the experiences and findings of the Chameleons project, is the identification and mapping of the essential skills through interviews with employers, PhD graduates and educators.

Furthermore, projects identified different training models for implementing courses and learning methodologies.

Training for researchers is structured around different types of events and instruments, which can be combined in various ways and include summer schools, webinars, e-learning resources, train-the-trainer activities, collaboration and on-the-job training.

DocEnhance developed three courses in 'Data stewardship', 'Career management & entrepreneurship' and 'Supervision', featuring an innovative modular structure to foster open education, interdisciplinarity and inter-sectoral mobility. Each course has three modules targeting a crucial educational component. The first module, a massive open online course piloted by DocEnhance, targets open education and includes online lectures. The second module focuses on interdisciplinarity and involves local group work. The third module, designed to boost the employment mobility of PhD candidates, incorporates regional assignments in non-academic sectors. Courses can be used for self-learning or as a collective resource, easily adaptable to existing curriculum and are available on the [DocEnhance platform](#).

The **DISCOVERY LEARNING** core activity consisted of the design of a learning methodology, a training process designed to take trainees through integral learning cycles embracing the potential of blended learning, including gamification, to maximise impact at both the individual and institutional levels. Skills development is facilitated through central pedagogical approaches, like problem-based learning.

ProdPhD applied the 'training by doing' concept as a key framework to develop a large set of different skills.

InnEO Space_PhD employed the pedagogical methodology known as small private online course, containing e-learning resources which are added to an e-learning platform. Unlike a massive open online course, the small private online course targets specialised audiences.

VERSA focused on developing and using video games, designed with educational objectives, as a medium for skills training. These games are tailored to impact specific skills or knowledge,

engaging users in an interactive manner. The skills range from cognitive and problem-solving skills to more specific professional or educational competencies.

Most projects repeated the training programmes during different project implementation phases, in order to use previous experience to improve course content and delivery.

Finally, early-career researchers received support through different means to identify skills development needs in relation to their own career goals.

DocTalent4EU used skill-specific competence frameworks to provide local talent management services through seven local talent management centres across Europe, projecting career options and involving the non-academic sector in training and career development.

Chameleons used a career-mentoring panel composed of both academic and industry mentors.

Enablecares set up a local career advice support team to guide and help PhD candidates.

Critical Making developed an analytical framework that synergises the principles of the grassroots innovation movement with aspects of responsible R&I and responsible making principles. This offers a promising lens to critically evaluate the innovation processes within the maker movement, focusing on their responsible R&I alignment and social responsibility commitments. The [critical making toolkit](#) contains best practices and learnings to support participatory-reflexive practices amongst maker communities to implement dedicated practices.

Based on this analysis, it becomes clear that beyond involvement in the identification phase of training needs or in mentoring, the level of involvement from the non-academic sector reported by the projects is rather modest. Further engagement with the non-academic sector could be strengthened, to reinforce researchers' capacity and broaden career opportunities.

(4) Pilot implementation

Several projects piloted courses and made course materials publicly available on project websites or newly created platforms.

ISPAS learning materials are available in the ISPAS [Zenodo](#) community and all files are licensed under the Creative Commons Attribution 4.0 International Public License. Feedback on both the design and trials from several groups of the stakeholders was collected.

Chameleons used additional learning opportunities, offered by third-party platforms, and developed the [state-of-the-art toolkit](#) with Google Classroom. Numerous platforms providing online courses were identified, such as [Coursera](#), [udacity](#) and [FutureLearn](#), along with YouTube channels or [IEEEtv](#), in order to create a list of relevant modules and materials. The toolkit is categorised into five main areas: (1) research and writing skills; (2) career management; (3) programming and data analysis; (4) business; and (5) other. Each category

is further divided into subcategories, to make it easier for users to identify the modules of their preference.

DocEnhance and **DocTalent4EU** compiled a list of recommended third-party courses, while further expanding the array of training possibilities.

(5) Skills / course certification

This dimension focuses on the methods and tools for recognising acquired skills.

OPENING DOORS, **Chameleons** and **InnEO Space_PhD** integrated transferable skills courses in PhD programmes awarding [European Credit Transfer and Accumulation System](#) (ECTS) credits, which triggered a good level of participation and motivated students, while contributing to testing and validating training materials.

DocEnhance developed recommendations for the evaluation and accreditation of PhD courses in transferable skills, drawing on the insights gained from multiple rounds of piloting courses across partner institutions. The recommendation document describes general and specific criteria that should be taken into consideration for the evaluation of PhD courses in transferable skills (such as course content, practical organisation and interaction with the non-academic sector). It also lists recommendations for the accreditation of PhD courses on transferable skills, including the use of European Credit Transfer and Accumulation System credits, [micro credentials](#) and certificates.

DocTalent4EU is creating an innovative recognition system for the transferable skills of early-career researchers in the context of doctoral training and research activities. The final aim is to establish digital credentials, issued by consortium partners, that will contribute to increasing the visibility of transferable skills in researchers' curricula, benefiting research careers. The digital credentials, licensed under a Creative Commons non-commercial license and branded as [DocTalent4EU credentials](#), will be developed referring to the ESCO classification and ResearchComp. The project will focus on creating 10 DocTalent4EU credentials that acknowledge a range of skills acquired through formal, non-formal and informal learning, both within and outside academia, aligning with the demands of the current employment market.

Skills4EOSC provides a [collaborative, adaptable and inclusive framework](#), focusing on digital/data skills and using existing technologies for recognising competencies within the EOSC ecosystem. A shared recognition framework relies on common standards for skills recognition across various institutions and stakeholders, aligning with EOSC ecosystem objectives and infrastructure while focusing on crucial competencies like data management and digital tool usage. The framework is flexible and scalable by adapting to emerging skills and evolving EOSC community needs and provides cross-border skills recognition. It also acknowledges a wide range of expertise and experiences and ensures inclusivity and diversity, also using digital tools like badges and blockchains for verifiable credentials.

(6) Knowledge sharing

This dimension focuses on tools that enable the adoption and sustainability of results beyond the project duration, such as train-the-trainer modules, mobility and exchange programmes

and communities of practice. Several projects analysed initiated communities of practice and open platforms for knowledge sharing purposes.

A group of PhD candidates who took part in the **OPENING DOORS** training course developed the Agape collaborative platform. Agape is an online community on open science created by PhD candidates for PhD candidates. Agape includes key information on the practical elements of open science that is needed for the PhD journey, with associated learning activities.

DISCOVERY LEARNING used the [open educational experiences platform](#), a community of practice that gathers personal strategies from trainers engaged with diverse people in different contexts.

CRITICAL MAKING developed [guidelines](#) on how to facilitate dedicated communities such as the makers' community.

ERA TALENT supports the implementation of the ERA policy agenda on research careers and enhances the Euraxess network services, through career diversification support for researchers, thereby widening career paths in academia, industry and business. ERA TALENT features five thematic hubs: the Euraxess Startup Hub, the Researcher Careers Beyond Academia Hub, the Researcher Careers in Academia Hub, the Talent Circulation Hub and the Euraxess Science 4 Refugees Hub. The platform hosts six communities of practice, offering centralised access to diverse information and support services. These elements foster a collaborative environment for knowledge exchange, enhancing talent management services and addressing key career development challenges for researchers. A significant focus of the project is on improving employability and talent attraction and retention, along with mobility, benefiting individual researchers and contributing to the dynamism of the European research landscape.

The **DIOSI** [model for doctoral training and 'Train-the-trainer' tools](#) is highly valuable and relevant in PhD education, as it serves institutional roadmaps facilitating the implementation of defined doctoral training programmes and enhances skills training in open science, open innovation and entrepreneurship.

DocEnhance and **DocTalent4EU** created [a PhD hub portal](#) as a single, sustainable online platform which centralises different types of learning opportunities for researchers, including courses, internships, job offers and funding opportunities. Additional courses for PhD candidates will be uploaded in 2024 by DocTalent4EU, focusing on communication, negotiation, science diplomacy, teamwork and networking, personal effectiveness and leadership.

(7) Impact assessment

This dimension focuses on analysing how projects measured the impact of training delivered and skill acquisition on researchers' careers. Several projects developed specialised frameworks and tools for impact assessment, to evaluate the outcomes of specific training and skills development initiatives.

SKIES designed and used questionnaires and semi-structured interviews to facilitate evaluations.

DIOSI introduced an [impact and graduate tracking framework](#), incorporating a self-report questionnaire tailored to the course contents and methodology, enabling the assessment of long-term impact.

DocEnhance developed [recommendations](#) in the form of guidelines for universities wishing to implement a career-tracking survey for postgraduate researchers. Recommendations serve as a useful resource for both European and non-European universities, addressing key aspects such as survey design, planning, survey management and legal considerations. The guidelines include specific survey questions and reference data from surveys conducted at nine European universities in 2021. Overall, it provides a comprehensive and practical framework for institutions seeking to improve their doctoral graduate tracking process.

SECURE carried out a literature review on career development and progression for researchers. The review concluded with the fact that training and counselling should be considered as one of the main categories, crucial for career development and progression. Support structures for career planning developed by SECURE include general guidance and specialised trainings, along with suitable tools. The final aim is to share recommendations on how transversal skills training of researchers would be structured while improving their career perspectives.

3. Skills in European University Alliances projects

The alliances were originally funded by Erasmus+ beginning in 2019, and since 2020 this has been complemented with funding for capacity-building activities in R&I through two pilot calls in Horizon 2020. The R&I funding of the alliances has so far focused on supporting their work on a range of transformation modules, through which they have had the opportunity to develop innovative approaches to building capacity and joint strategies through more integrated collaboration between the participating institutions. The alliances' focus on developing transnational and even harmonised or integrated approaches at the institutional level, together with their connections to EU and national policy development and their mission to serve as role models for the wider university sector, makes them a promising setting for advancing the research assessment reform. In April 2023, the report [Progress of University Alliance Projects](#) was published for projects funded under Horizon 2020 IBA-SwafS-Support-1-2020 Call – Pilot I, building on their interim evaluations.

The present report complements the review process and analysis on their progress and good practices by describing and analysing the activities and contributions related to researcher skills that have so far stemmed from the R&I funded projects of the alliances.

The alliances significantly impact the career trajectories of researchers in Europe. They are instrumental in contributing to institutional transformations and creating a dynamic academic and professional landscape that transcends national borders, sectors and disciplinary boundaries, thereby broadening career prospects and facilitating seamless career transitions for individuals across Europe.

Central to their strategy is the development of innovative curricula, including new teaching approaches that modernise the educational experience with contemporary content and methodologies, directly benefiting researchers in their teaching skills. The emphasis on mobility and exchange programmes is particularly beneficial for researchers, enhancing their intercultural understanding and language skills while building resilience as they navigate diverse academic environments.

A key feature of the alliances is their transdisciplinary approach, which transcends traditional academic boundaries. This approach is instrumental for researchers, fostering critical thinking, broadening perspectives and encouraging collaboration across various disciplines. It equips them with practical skills but also opens doors to extensive professional networking opportunities, crucial for building a successful research career.

The initiative also supports university lifelong learning, instilling in researchers a mindset geared towards continuous development and adaptation in a rapidly evolving world. This is particularly relevant given the dynamic nature of research fields. Additionally, the focus on digitalisation is crucial, enhancing researchers' digital literacy and preparing them for effective online collaboration, a necessity in today's technology-driven research environment.

Furthermore, the alliances emphasise R&I as a cornerstone for developing researchers' analytical thinking. By engaging in hands-on research projects, researchers are encouraged to be creative, refine their problem-solving skills and gain valuable project management

experience. Overall, the alliances shape a new generation of versatile and adaptable researchers, equipped to tackle the complex challenges of the global research landscape.

3.1. Analysis of the transformation module ‘strengthening research careers’ with links to researchers’ skills and research management skills

The transformation modules developed by the alliance projects, particularly the one on strengthening human capital, underscore the importance of skills such as pedagogy, forward-looking competencies, open science, research integrity, interdisciplinary knowledge and entrepreneurship. The emphasis on promoting talent, providing training and mentoring for researchers and research managers, involving experts from other sectors and promoting lifelong learning, aligns with the needs of the European R&I landscape.

Analysis reveals that the alliances have developed limited but significant initiatives, aimed specifically at the upskilling of researchers or research managers.

The broad range of transformation modules covered by the alliance projects have drawn the focus to other core topics that are needed to support their R&I dimension, enabling joint human resources strategies for researchers, such as national regulatory frameworks, barriers for research careers, research assessment, gender equality and talent management, among others.

In the context of the transformation module on strengthening human capital, projects also discussed the establishment of a European-level tenure-track system model and how to address academic/researcher career assessment. This may well have led to a narrower perspective on joint actions for research and research management skill development.

3.2. Main findings and good practices

Some initial observations and comments on how the alliance projects contribute to the development of skills have emerged. The projects organised interesting skills development actions for both researchers and research managers. Projects primarily concentrated on the design of training opportunities for researchers, but recent updates reveal a shift, expanding the focus to include training and networking for research managers. While the primary emphasis remains on empowering researchers, there is a growing recognition of the pivotal roles played by research managers in the overall research ecosystem and the success of the alliances.

reSEArch-EU has developed the [SEA-EU Academy](#), an online training platform designed to enhance researchers’ skills, encompassing both soft and hard skills, to enable researchers to better comprehend and adapt to emerging trends in remote research, innovation and sustainability.

CIVICA Research implemented [excellence tours](#), engaging researchers in collaborative learning through mentoring and transferable skills training. Leading scholars are invited to

conduct seminars or participate in workshops and early-career researchers are given the opportunity to share insights through talks, expanding their professional networks.

SMART-ER organised the [SMART-ER Academy](#) that comprises nine courses of an online PhD training programme and eight courses of the open science and leadership blended-training programme.

EUTOPIA-TRAIN has established a community of practice on citizen science to foster peer learning and training. A comprehensive guide on [how to get started with citizen science](#) has been created, serving as a valuable resource for researchers seeking to understand and implement citizen science projects.

Arqus' gathers recommendations on which skills and competences could be included in an 'alternative' assessment paradigm.

RUN-EU PLUS has developed the [Researcher Career Development Training Programme](#) which has been implemented across the RUN-EU alliance and continues to be delivered by the RUN-EU PLUS team. Topics covered include open science practices, attractive researcher careers and approaches to early-stage supervision.

During the second half of the alliance projects – Pilot I, there has been a focus on skill development for support staff and research management.

The **ECIU** strategic European project office by **SMART-ER** and the **IRIS** network by **Unite.H2020** aim to strengthen the competencies of research managers and administrators. ECIU links all research managers in all ECIU partner institutions to exchange practices, organise trainings and network for future funding applications, while the IRIS network establishes a network of research support officers in the UNITE.H2020 institutions, providing integrated R&I support services.

The analysed training initiatives for researchers have predominantly centred around open science and data management skills. There are diverging levels of implementation for open science across the members of the different alliance projects screened.

For example, **reSEArch-EU**, **Una.Resin** and **YUFERING** organised workshops and developed information materials on open science to raise awareness among staff and researchers. **SMART-ER** developed [training courses and training materials](#) on open science for researchers and trainers. **EUNICE** developed a [conceptual framework](#) around five key elements, assisting in the development of strategies for open science activities and establishing a unified approach to open science within the alliance.

Delivery methods for the training are predominantly used in workshops and on online training platforms.

For example, **EUniWell Research** established a [Research Training Academy](#), fostering up-skilling and re-skilling with a focus on well-being, consolidating a community of researchers. Through a partnership with VITAE, EUniWell researchers gain access to the [researcher development framework](#), enabling researchers to track their skills gap with an emphasis on

well-being.

There are few training programmes and tools dedicated to open innovation and entrepreneurship.

For example, **INVEST4EXCELLENCE** developed a [research, development and innovation matrix](#) with key competencies, skills and knowledge, in relation to sustainable supply chains, based on a thorough methodology including case studies and focus group interviews. The matrix is used to identify training needs for future implementation. The 'Learning labs' support individual researchers and aim at sustainable regional development.

There is limited involvement with the non-academic sector when conducting training needs analyses. Engagement with regional non-academic stakeholders in training activities could be further improved and there is potential for further exploration and development, embracing training opportunities, aligned with the broader landscape of innovation within and beyond academia.

For example, **ENGAGE.EU R-I** engaged with [City Labs](#) and developed a toolkit helping alliance partners in creating local strategies for entrepreneurial ecosystems with local stakeholders, networks and partnerships. This flexible toolkit outlines essential activities and provides optional ones for developing local strategies.

4. Skills for research management

Research management is integral to the successful implementation, oversight and delivery of research activities. The ERA recognises the pivotal role of research management in ensuring the efficiency, effectiveness and relevance of research endeavours, especially in the rapidly evolving global research landscape. In the dynamic and collaborative context of the ERA, research management serves as the backbone, ensuring that research endeavours are not only academically sound, but also administratively efficient, ethically compliant and societally relevant.

Building capacity is a key process, especially for institutions with less-developed research infrastructures. This involves organising training sessions and workshops and promoting interinstitutional collaborations to bolster research management skills and foster a cohesive research environment. Research managers play a pivotal role in this process, by supporting researchers and research projects, facilitating industry collaborations, managing intellectual property issues and ensuring that research has a tangible societal and economic impact. Research management tasks include, among others, the mobilisation of resources, project management, negotiation, research evaluation and promotion of open-access publications, also ensuring compliance with EU-wide ethical norms, particularly in areas like data privacy, human rights and environmental sustainability. Research managers also help across an extensive array of areas throughout the research project lifecycle. This includes stages such as pre award, contracting, post award, financial oversight, communication and legal matters. Additionally, they play roles in knowledge and innovation management, research policy, research funding, data handling and overseeing research support services.

However, the research manager profession in Europe largely goes unnoticed in areas like policy, career growth and tenure opportunities. This absence of recognition is coupled with a significant variation among countries, funders, policymakers and individual institutions in their approach to research management.

Across Europe, there is a notable variation in research management job roles and titles, meaning that similar roles might be labelled differently in various institutions and countries. Additionally, the depth of specialisation can vary, where one institution may employ someone with a generalist role, while another might recruit a specialist, such as a data steward, open science specialist, technology transfer officer or licensing manager. The size of the institutions and the nature of the research support offices often dictate the specificity of research management roles.

There are several European initiatives that aim to standardise, improve, advocate for and ensure the inclusivity of research management across Europe. The structured approach not only enhances the profession's efficacy, but also ensures alignment with European values and strategic goals. Additionally, European policies encourage cross-border and interdisciplinary research collaborations, recognising the importance of addressing complex global challenges and aiming to simplify administrative, legal and financial matters, all while fostering an integrated ERA.

CARDEA and **RM Roadmap**, addressing Action 17 of the 2022–2024 ERA policy agenda, are currently mapping and analysing the European landscape of research management. Mapping exercises in research management cover a wide scope of activities supporting skill development, such as training sessions, study visits, staff exchange, internships and opportunities for exchange of good practices. Based on the results, guidelines for research managers and policy recommendations will be formulated on how to best build and deliver research management and support services under the new ERA.

It should be noted that **CARDEA** is developing a career and competence framework for research managers, and that **RM Roadmap** has established a Europe-wide network of national research management ambassadors, creating or maintaining communities at the national level in over 40 countries.

RitrainPlus aspires to equip future operators and research managers of pan-European research infrastructures and core facilities across various domains, with new skills and qualifications, paving the way for a specific career trajectory through certified training programmes, particularly focusing on enhancing data management, exploitation and stewardship abilities.

HORIZON-WIDERA-2021-ERA-01-20 – Towards a Europe-wide training and networking scheme for research managers	HORIZON-2020-INFRA-SUPP-02-2020 – Strengthening the human capital of research infrastructures
<p>CARDEA Career acknowledgement for research (managers) delivering for the European area</p>	<p>RitrainPlus Research infrastructure training plus</p>
<p>RM Roadmap Establishing framework conditions for research management to strengthen the European research area</p>	

In general, the analysed projects aim to reach a wide community of research managers active across the ERA, with the intention of exploring the possibility of creating new training pathways dedicated to research management. The projects also aim to optimise the integration of existing recognised institutional training and certification programmes in research management. All three projects contribute to strengthening research managers’ diverse and crucial roles, thus improving their skills and amplifying Europe’s R&I distinction.

4.1. Analysis on skills for research management

CARDEA and **RM Roadmap** will establish targeted interventions to present an evidence-based understanding of the research management profession. They use insights from completed surveys and online co-creation events across nearly 40 countries to delineate the challenges faced by research managers today and will support the community through existing sources for training, networking, funding and mobility.

Both projects also intend to introduce innovative solutions, such as the professional development framework and the business case for research managers, along with the capacity

maturity model to evaluate and refine research management functions. Innovative research management knowledge and community platforms and hubs are also foreseen, designed for networking and training and fostering a shared learning space.

CARDEA aims at becoming a resilient research management network and hub while also developing a research manager career framework to improve research management career growth and monitoring. The groundwork prepared enables the proposition of a European research management charter progressively shaping research management activities, in line with the European charter for researchers.

The **RM ROADMAP** initiative crafts a strategic direction for the evolution of research management in Europe while fostering a supportive community for its execution. RM Roadmap's primary goal is to analyse and tailor the foundational assets of research management in the European Union, including those in widening Horizon Europe Member States. This aims to address the changing needs relating to defining and categorising roles of research managers. It also focuses on identifying the essential skills for these roles, aligning with the activities carried out by CARDEA.

Both projects aim to bolster strategic, transnational collaborations among research managers spanning various sectors: industry, research-funding organisations, higher academia and broader research establishments. In addition, there are plans to bridge existing European networks through advanced community platforms. These platforms promise a pioneering co-creation model in global research management, along with a research management knowledge hub including a virtual learning environment and training.

RltrainPlus is dedicated to equipping future operators and managers of research infrastructures across various domains with a new qualification, paving the way for a specific career trajectory also through certified training programmes, which will be open for all European universities and for all European qualification framework levels (BSc, MSc, PhD). RltrainPlus initiated ways to fill competency gaps and enhanced managerial capacities through multifaceted educational programmes. A distinctive train-the-trainer model is being developed, aimed at the creation of scalable and sustainable training pathways, ensured via user and trainer kits and a coaching programme for professionals in research infrastructures, gearing them towards certified executive coaching.

The ultimate ambition of RltrainPlus is to establish a self-sustainable European school of management for research infrastructures that provides specialised training and workshops addressing governance, management, organisation, finances, socioeconomic impact analysis and internationalisation of research infrastructures and core facilities, and also certifies courses and learning activities.

4.2. Main findings and good practices

CARDEA's capability maturity model will create a standard framework to evaluate the maturity and effectiveness of research management professionalisation. Organisations will be able to benchmark their progress and implement continuous improvements. Developing a competency framework will ensure that research managers across Europe possess the essential skills and knowledge, aligning the profession with the strategic goals of the ERA.

In addition, the planned European hub for research managers will serve as a centralised location for research managers across Europe to share knowledge, collaborate and learn from one another.

RM Roadmap aims at guiding and influencing European policy, tailored to suit specific research management objectives. While RM Roadmap does not prescribe a one-size-fits-all solution, it will serve as a framework for national organisations to participate in discussions and develop customised strategies.

CARDEA and RM Roadmap collaborate on a regular basis to maximise project impact and avoid undesirable duplication of efforts or results. RM Roadmap focuses on mapping what is available, while CARDEA focuses on building an open online tool to disseminate training targeted at research managers in Europe.

On the other hand, research infrastructures play a growing pivotal role in the scientific landscape, necessitating proficient management across scientific, political, ethical and managerial spheres. **RITrainPlus** can provide crucial input to the CARDEA and RM Roadmap projects, as it has updated the competence profiles for the professional management of European research infrastructures, previously identified by the RItrain project. By pursuing the accreditation and certification of learning activities, the project will help avoid fragmentation of the educational offer at the EU level. Final certifications of students acquiring the longitudinal learning track credits at different universities and different countries might be a challenge, if left to interactions between the registrars. Offering an enhanced Executive Master's for research infrastructures and core facilities/managers has a huge potential to improve EU research capacities. Staff exchange visits have already been conducted with very positive feedback and it is a good practice that they are also open to managers from research infrastructures and core facilities outside the project consortium.

After analysing these three projects in the context of skills development and progress, it seems evident that the research management profession deserves universal recognition and that there is a need to introduce a collective term and definition for research managers in the first place. However, to craft such a term, it is essential first to comprehend the multifaceted nature of research management roles. Given the diverse profiles, any broad categorisation will help in better recognition and understanding of research management roles.

Conclusions and recommendations

The projects analysed mainly focus on developing skills in open science, entrepreneurship and innovation, from local ecosystem analysis to educational resources, and aim to create a more dynamic and adaptable research workforce.

The tools developed by the projects commit to equipping mainly first-stage researchers (R1) with a broad spectrum of skills, from core academic competencies to transversal skills, necessary for innovation and market relevance. The findings and good practices identified provide valuable insights into the potential of initiatives to shape the future academic and R&I landscape, and also emphasise the importance of continuous impact evaluation and adaptation to ensure their enduring success and relevance.

Skills development in the context of the alliances is instrumental in piloting the new European framework for research careers established by the December 2023 Council recommendation, including ResearchComp. The alliances focus on developing human capital in R&I and are also expected to contribute to strengthening skills in the near future. A number of alliances have started developing and implementing training programmes aimed at enhancing the skills of researchers and research managers. The development of innovative platforms and training provisions underscore a commitment to comprehensive skill development, focusing not only on traditional research skills but also embracing emerging areas such as open science, data management and citizen science.

There is room for growth, particularly in the realms of open innovation, entrepreneurship and the involvement of non-academic sectors in research and research management training programmes. The current landscape presents an opportunity to further diversify training offers and collaborations, enriching the research ecosystem and fostering a more inclusive and dynamic approach to R&I.

The role of research managers has gained prominence, with initiatives aimed at enhancing their skills and professional recognition. A comprehensive review of research management in Europe is essential to understanding current practices and identifying areas for enhancement. Involving diverse stakeholders will ensure a well-rounded view and formal recognition of the research management profession. Offering dedicated training by professionals, and developing and integrating a clear research management framework assisting career development, remains crucial for the coming years. To guarantee that the profession receives the essential support and resources to flourish and progress, new European initiatives would be welcome, especially in policy domains for planning, monitoring and economic growth.

The following recommendations aim to foster a holistic approach to skill progress, integrating various frameworks and methodologies to enhance the capabilities of researchers and research managers across Europe.

(1) Development and utilisation of ResearchComp

- **ResearchComp platform.** Create a comprehensive catalogue of existing training courses, linked to the ERA talent platform and the 'Pact for Skills' webpages to promote Horizon

2020 and Horizon Europe skills-related project outputs, in line with the seven competence areas and four proficiency levels outlined in ResearchComp. This could also facilitate navigation for users looking for skills development opportunities. A similar approach could be applied for research management training, in line with the developments under CARDEA and RM Roadmap.

- **Methodology exchange and support.** Encourage the sharing of methodologies, including those used for impact measurement, among different entities. Provide support for the exchange among training programmes. Additionally, organise dedicated events, focused on skills development practices, facilitating a platform for cross-Member-State, cross-institutional and cross-disciplinary collaboration and learning. These initiatives aim to foster a community of practice and continuous improvement in skills development methodologies.
- **Skill validation and recognition.** Enhance the processes for validating and recognising skills acquired by researchers. Consider the use of ResearchComp in the context of an interactive self-evaluation tool that researchers can use to document and monitor their competencies. This approach will not only serve researchers in their professional development, but also ensure that their skill sets are formally recognised and valued.

Further improvements should be pursued by taking advantage of the direct link already established between the skills outlined in the updated ESCO classification and those covered by ResearchComp, along with the possibility of selecting and highlighting these skills in the [Europass CV](#).

- **Skills framework integration.** Promote the integration of ResearchComp with the development of the research managers competence framework. This effort aims to ensure alignment and interoperability between different skill frameworks, facilitating the mutual recognition of skills. Such integration is crucial for supporting diverse career pathways, allowing researchers to seamlessly perform various roles during their professional career. Furthermore, since research managers support researchers in their multiple activities, competence areas that are mentioned in the ResearchComp will also need to be reflected in the research management competence framework.

(2) Transversal skills and career assessment

- **Linking skills and assessment.** Focus on reinforcing the relationship between the recognition of transversal skills and the assessment of researchers. Implement ResearchComp as a key tool for evaluating competencies pertinent to various research roles. This approach aims to ensure that the assessment of researchers is comprehensive and accurate and reflects a wide range of essential skills beyond technical expertise.
- **Microcredential exploration.** Explore microcredentials for researchers aligned with the European approach to microcredentials for lifelong learning and employability to enable fluid talent flow between sectors. Microcredential courses could be developed for senior researchers (R3 and R4) for continuous professional development, and for research managers.

- **Involvement of non-academic stakeholders.** Promote cooperation between academia and other relevant ecosystem stakeholders in the design and delivery of transversal skills training, enhancing career prospects for researchers and meeting the skills needs in the private sector.

(3) Training and mentorship

- **Mentorship programmes.** Establish mentorship programmes for researchers and research managers in order to improve exposure to different career trajectories, particularly for early-career researchers, to gain valuable real-world insights, expand their professional network and improve their employability.
- **Career path guidance.** Create comprehensive resources and provide online training sessions on diverse career paths for early-career researchers, including in research management careers, covering roles in various sectors, such as academia, industry, government and non-profit sectors.
- **Curriculum integration.** Use ResearchComp in the design of PhD curricula to ensure comprehensive development of researchers' competencies, by acquiring a broad range of skills, aligning PhD training with the evolving demands of the current employment market.
- **Mandatory training modules.** Incorporate training modules focused on entrepreneurship, innovation and open science in all PhD programmes. This fully integrated and recognised mandatory training will equip researchers with critical skills needed in the current and future employment markets.

(4) Continuous development

- **Leveraging lessons learned.** Integrate the valuable output from funded projects and studies into the research management competence framework. This approach ensures that the framework is informed by real-world experiences and best practices, enhancing its relevance and effectiveness in addressing the current and future needs of research management professionals.
- **Feedback integration in alliances.** Actively explore and assess the skill development needs and experiences of researchers, research managers and support staff within the alliances. Insights would be used to continuously refine and improve future skills initiatives, tailored to effectively meet the evolving demands and challenges faced by key stakeholders.

(5) Training and skill development

- **Target group expansion.** Expand skill development initiatives to encompass R3 and R4 researchers, aligning with ResearchComp. Place a special focus on enhancing managerial skills for those in the leading researcher profiles, ensuring that future managers are equipped with the necessary competencies to effectively manage and lead in their respective fields and roles.

- **Tailored training for researchers.** Create specialised training programmes designed for R2 to R4 researchers, in order to standardise practices across various research groups and levels within institutions, ensuring a uniform approach to open science methodologies and principles.

Comprehensive skill development. Concentrate on the holistic development of skills pertinent to research management, preventing fragmentation in skill sets and career paths, facilitating the continuous professional development of research managers.

Training providers exchange. Identify relevant skills and training providers supporting the uptake of ResearchComp, while monitoring, matching and exchanging good practices as an important prerequisite of skills development.

(6) Impact measurement

- **Effective training programmes.** Implement strategic approaches for both mid-term and long-term evaluations of transversal skills training programmes. This involves establishing robust measurement methodologies, to assess the impact of these programmes accurately. By focusing on data-driven outcomes, the goal is to achieve a thorough and comprehensive impact assessment, ensuring that the training programmes effectively develop the necessary skills and contribute positively to the broader objectives of the organisation or institution over time.

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