Sustainable Careers for Researcher Empowerment

WP1
STATE-OF-THE-ART on Research Careers

Deliverable 1.1:
STATE-OF-THE-ART on Research Career Frameworks

SECURE
Sustainable Careers for Researcher Empowerment

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Table of Contents

1. Introduction

SECURE Work Package (WP) 1 - State-of-the-Art on existing literature and recommendations related to research career frameworks (RCFs) is focusing on recruitment and working conditions for researchers, career development and progression for researchers, and interinstitutional (between academic institutions), intersectoral (across sectors), and international (across countries) mobility.

The SECURE project aims at developing a RCF as a common researchers' career structure, recognising the diversification of careers, interinstitutional, intersectoral, and international mobility, and competences gained and needed by PhD candidates and postdocs within and outside academia. The RCF will build on existing best practices and link, as planned in the proposal, to the implementation and revision of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers (Charter and Code)[1], the revision of the European Skills/Competences, Qualifications and Occupations (ESCO)[2], the new European Competence Framework for Researchers, and the upcoming Council Recommendations on a European Framework to Attract and Retain Research, Innovation, and Entrepreneurial Talents.

Relevant existing literature and recommendations have been reviewed which focus on recruitment and working conditions for researchers, career development and progression for researchers, and interinstitutional, intersectoral, and international mobility. The reviews include key topics of research(er) assessment, research and transversal skills/competencies and training, research career precarity, gender equality, and Open Science. Finally, the reviews reflect on research careers in both the public and private sectors. The state-of-the-art will mainly feed into the work in:

- WP2 on the development of the RCF;
- WP3 on the development of tenure track-like (TTL) models;
- WP4 on the implementation and monitoring of the RCF at pilot organisations.

Deliverable 1.1 - *State of the Art on Research Career Frameworks* has the overall objective to present the results of the literature review and provide input to the project's overall objective to *"develop coordination and support measures to create, trial, implement, and mainstream a common* [RCF] *that offers a suite of options to support organisations in the recruitment, employment, training, development, progression, and mobility of researchers with the aim of improving research careers and reducing career precarity."* The presented work will further evolve in subsequent WPs, through consultation and testing.

The subsequent chapters of this deliverable are structured as follows:

- Chapter 2: Overall Methodology for Literature Review
- Chapter 3: Overall Overview on Research Career Frameworks
- Chapter 4: Recruitment and Working Conditions for Researchers
- Chapter 5: Career Development and Progression for Researchers
- Chapter 6: Interinstitutional, Intersectoral, and International mobility
- Chapter 7: Conclusions and Input to WP2/WP3/WP4
- Chapter 8: Annexes - Full Bibliography

[1] European Commission. European Charter for Researchers and Code of Conduct for the Recruitment of Researchers (2005) - https://euraxess.ec.europa.eu/sites/default/files/am509774cee_en_e4.pdf

[2] European Commission. ESCO European Skills/Competences, Qualifications and Occupations (2020) - https://ec.europa.eu/social/main.jsp?catId=1326&langId=en

2. Overall Methodology for Literature Review

2.1 Vocabulary and Scope of the Literature Review

Researchers, according to Frascati, *"are professionals engaged in the conception or creation of new knowledge"*. Consequently, the following two terms "researcher career" and "research career" refer both to a professional career related to research performance. Slight differences in the meaning might depend on the context. "Researcher career" typically stands for professional paths with a primary focus on preforming research, which includes scientists, research assistants, and members of research staff (e.g., analysts). "Research career" is a somewhat broader term and includes jobs with research-related activities, such as research and development manager or data analyst. Hence, the term "research career" is not restricted to the specific role of an individual as a scientific researcher but rather refers to careers in which research skills and experience is important.

Due to the lack of a clear definition of a "Research Career Framework" (RCF), several concepts apply and may depend on the context. The European Commission (EC) defines an RCF as a concept which "*describe*[s] *the generality of the research career in commonly understood terms* [and] *could help to establish 'comparable research career structures'* […] *supporting measures to remove obstacles to mobility and cross-border cooperation*"[3]. In addition, a *"research career framework should describe the knowledge, behaviour and attributes of successful researchers*"[4] (VITAE). Finally, the Commission believes that the proposal for a pan-European framework for research careers "*should also highlight and strengthen the link between research careers, entrepreneurship and innovation"*[5].

The SECURE project aims at developing a RCF built on a structured and comprehensive set of guidelines, principles, and practices that aim to support the professional development of researchers at various stages of their careers. The landscaping of key literature on RCFs carried out in the context of the SECURE WP1 literature review provides an overview of the topic. The outcomes of this literature review will directly feed into the WP2, WP3, and WP4 and provide relevant information for the next steps towards a first draft of an RCF. Overall, the RCF should support researchers to develop their skills, knowledge, and expertise and provide guidance on the expectations and requirements for career progression.

2.2 Background to SECURE Bibliographical Analysis

Partners of the SECURE consortium performed a systematic bibliographic analysis to identify the main literature available related to the concept of "research career frameworks" and other areas of interest to the SECURE project. SECURE partners agreed on using the Scopus[6] database as the tool for the bibliographical analysis. Scopus is an abstract and citation database for research publications that contains over 1.8 billion cited references. This decision was made after a comparative test search with OpenAire|Explore[7], an open discovery portal covering a comprehensive and open dataset of research information. OpenAire|Explore was considered as an openly accessible, meaning free at the point of use, alternative to conduct the literature review.

Separate searches were conducted for search terms in "title", and "abstract", and "keywords" ("subject" for the search in OpenAire|Explore[8]). A comparison of the search results is provided in Table 2.1 Comparison of Search

[3] European Commission. Towards a European Framework for Research Careers (2011)
[4] Vitae. Researcher Development Framework (2010) - https://www.vitae.ac.uk/vitae-publications/rdf-related/researcher-development-framework-rdf-vitae.pdf/view
[5] European Commission. Technical Document on a European Framework for Research Careers. Unpublished document for ERAC Plenary Meeting in February 2023 (2023)
[6] https://www.scopus.com/
[7] https://explore.openaire.eu
[8] Additional search filter options for article, book, and part of book were selected

Results from Scopus and OpenAire|Explore Table 2.1. The number of identified sources was interestingly comparable, however there was little overlap. The documents identified by Scopus were more relevant to the project and the user interface was more user-friendly than OpenAire|Explore. To avoid using two different databases and to keep the work within the scope and available resources allocated to WP1, the task leaders decided to use Scopus as the sole database and to complement it with literature already known to the consortium. The latter is important since grey literature, including relevant policy reports or position papers, often reflect more on concrete actions and implementation plans but are usually not discovered by databases, such as Scopus, that are predominantly targeting academic publications.

Table 2.1 Comparison of Search Results from Scopus and OpenAire|Explore on Research(er) Career Framework

Search Terms	AND	Scopus Search total hits [open access]	OpenAire|Explore Search total hits [open access]
research*	career framework*	56 [20]	55 [24]

For consistency reasons, partners leading Tasks 1 and 2 in WP1 agreed on the same methodological approach for the state of the art of RCFs presented in this deliverable (D1.1) and *D1.2 State-of-the-Art on Tenure Track-Like Models* developed in parallel for WP1.

2.3 SECURE Bibliographical Analysis

The methodological approach for the bibliographical analysis was undertaken for each of the three sub-tasks. To keep the searches in the scope of this deliverable, the search was restricted to a set of common and specific search terms across the chapters and focused on relatively recent published after 2000. A slightly different approach was followed for the overarching search on RCFs presented in Chapter 3 (details are explained in the respective section).

The general approach consisted of 8 steps:

1) Define purposeful search terms and relevant variations of the terms (note the difference between single search words vs. search word combinations);
2) Create one set of common search terms applicable to all subtasks and a second set of specific search terms for each of the individual subtasks;
3) Search the publication database combining search terms from the two sets and export the search results into a spreadsheet;
4) Choose the cut-off date for searching relevant publication as year 2000 ;
5) Combine the extracts of the Scopus results for the selected search word combinations in one single spreadsheet and identify duplicates. Keep note of how often the article appears and delete the affected rows to cut down the list;
6) Assess the relevance of found articles by analysing the abstracts and categorising them according to the titles (yes/maybe/no);
7) Compile a final list of articles to be reviewed;
8) Complement the Scopus search results with additional key literature previously identified and collected from the consortium partners (list of core literature).

Steps 1 to 5 were completed by the task leader, who then shared the full Scopus list with the sub-task leaders for steps 6 to 8. Sub-tasks were assigned to sub-task leaders based on their topic expertise and their allocated effort in WP1.

The set of common search terms defined for all sub-tasks is listed below. The bases of the terms were chosen to include relevant variations of the term. For example, the search term 'research*' produces results that include 'researcher' and 'researchers':

- research* assess*
- research* eval*
- scien* assess*
- scien* eval*
- academ* assess*
- academ* eval*
- research* career*
- scien* career*
- academ* career*
- career framework*

This set of common key search terms was combined with specific search terms for each of the individual sub-tasks as described for step 3. Details of the specific combinations used for the sub-tasks are described in the methodology part of the individual chapters. After compiling all Scopus search results for one sub-task and excluding any duplicates (step 5), the lists were provided to the respective sub-task leader. To identify relevant publications of interest for SECURE, partners filtered down from the initial list to articles covering the aspects of their sub-tasks following step 6 and 7 and started the literature review. Moreover, each sub-task leader was asked to complement their literature list with additional literature relevant for their task, including literature recommended by the consortium (step 8). The list of core literature (titles will be written in bold) mentioned in step 8 had been identified by the consortium partners as relevant literature for SECURE but as unlikely to come up in the Scopus search. Articles from this list include mostly 'grey literature', i.e., non-academic publications, such as policy papers, reports, position statements from the European Commission (EC) or relevant stakeholder organisations.

More details on the process and outcome of the analysis for each sub-task are included in the individual sections of Chapters 3-6. A full overview of all articles selected to be reviewed for each sub-chapter can be found in the Annexes of this document (Chapter 8).

For the review, task members were provided with a common template in which they were asked to document according to the following extracted data:

- Title / Author / Year / DOI / Publisher / Publication
- Open Access (Yes/No) and Link
- Reviewer
- Article Abstract
- Summary of relevance for SECURE on RCFs
- Relevant information for A1.1.2 Recruitment and employment conditions for researchers
- Relevant information for A1.1.3 Career development and progression for researchers
- Relevant information for A1.1.4 Interinstitutional, intersectoral, and international mobility
- Any other relevant information on TTL models
- Relevant examples of best practices
- Any other references that should be reviewed.

Completed review documents were uploaded onto the shared repository. Upon completion of the reviews, an on-line meeting was held with the core partners involved in the review to discuss the findings.

SECURE partners acknowledge certain limitations to the literature review based on the decisions made with regards to the search, including the choice of the search tool (e.g., Scopus and its more academic focus) and search terms, and the selection process of the documents. In this context, relevant documents might be missing from the study. However, along with the overall approach of choosing a widely used and renowned databases for bibliometric analyses and of complementing the search results with core literature, a significant effort was made to cross-check search criteria to ensure that most relevant literature was covered.

3. Overall Overview on Research Career Frameworks (RCFs)

This section presents the results of the literature review on RCFs. First, the methodology used for the search and the results of the searches are presented. Then an overview is given of initial observations and key input from the literature review for RCFs. The results of this literature review provide input mainly into WP2 as well as into WP3. The full list of articles reviewed is available in Annex 1 – Articles Reviewed for Research Career Frameworks.

3.1 Methodology and Overview of Search Results

A bibliographical search was conducted to identify key literature on RCFs. Consistent with the overall approach, the methodology for searching and selecting key publications consisted of 8 consecutive steps (in line with the approach described in Chapter 2 Overall Methodology for Literature Review).

Step 1 *- Identify relevant key terms specific for the literature search on "research career framework" in Scopus.*

In order to keep the types of search terms consistent between the searches for the individual chapters of this deliverable, the following two search terms were selected for the search related to "research career framework":

- research*
- career framework*

Steps 2 - 4 *- Combine search terms for the search in the Scopus database and choose the publication year of 2000 as cut-off date.*

The Scopus search on "research career framework" differs slightly from the other searches in terms of the search term combination. Only the two common search terms identified in step 1 were used and produced 56 hits, see Table 3.1.

Table 3.1 Results of Search Term Combinations in Scopus

Common Search Term	AND Common Search Terms Combination	Number of Hits
research*	career framework*	56

Steps 5 - 8 *– Combine Scopus extracts, eliminated duplicates and assess the relevance of the article according to the titles and further confirm relevance by scanning the abstracts. Compile a final list of articles from the Scopus search and complement with additional key literature previously identified.*

This list of 56 articles was reduced following steps 5 and 6 leading to 4 relevant articles emerging from the Scopus search. 2 of the 4 articles were not openly accessible, hence only the 2 open publications were selected. Considering the low number of academic articles relevant to SECURE, this chapter almost exclusively focuses on a selection of 33 extra articles that were identified by the consortium as being potentially relevant for the SECURE project. Based on their expertise in the field related to the ERA actions and their geographical background, partners were asked to suggest essential literature that should be considered in the project. These articles were predominantly not peer-reviewed academic publications but rather 'grey literature' and included policy papers from the European Commission, policy papers from stakeholder organisations, and reports from expert groups at the European Commission (EC).

The 2 articles from the Scopus search were added to this extra list of literature resulting in the final number of 35 critical articles to be reviewed (in Table 3.2). During the review 29 publications from this final list were further classified as core literature for SECURE (the titles of these publications are in bold). For the full list of critical

articles reviewed in this chapter, i.e., the final list, see Annex 1 – Articles Reviewed for Research Career Frameworks (note, the table separates the final list into core documents and additional literature). The following chapters will also in part refer to these core documents.

Table 3.2 Number of Key Articles Remaining after Screening and Final List

Scopus Search Results	Duplicate Articles Removed	Articles Remaining After Screening	Extra Articles Added	Critical Articles Reviewed (Final List)
56	0	4 (only 2 accessible)	33	35 (29 core literature)

The SECURE consortium recognises that the selection of critical key articles related to RCFs and associated aspects may not be comprehensive. To address this, the consortium plans to broaden insights from the state-of-the-art through engagement with project partners, incorporation of additional literature, and gathering feedback from the community, including the pilot questionnaires from WP2 and WP3. This feedback will help the development of the RCF in WP2.

3.2 Overview on Research Career Frameworks

Observations on the current situation of researchers and research career frameworks

The current research career system in Europe is characterised by a number of challenges, including limited career prospects, lack of job security and poor working conditions, and a lack of opportunities for professional development and mobility. While the overall demand for research and the importance of science and technology in society has been growing, it has become urgent to address the challenges researchers face in order to create a sustainable research environment. ERA action 4 under the current European Research Area (ERA), also known as "New standards and guidelines for quality research careers", aims to improve the quality and attractiveness of research careers in Europe. The specific objectives of action 4 include the establishment of a set of quality standards for research careers, the development of guidelines for the assessment and evaluation of research careers, and the promotion of best practices for the support of research careers across Europe.

This need for a change in the current research career system in Europe is also reflected in our literature review. In particular, the lack of a clear and more transparent RCF at the European level negatively impacts the attractiveness, retention, and mobility of researchers within the European research landscape. Thus, the literature demands the implementation of new guidance for research career development in order to improve recruitment and working conditions as well as career development and professional growth through for instance better opportunities for interinstitutional, intersectoral, and international mobility. Several recommendations have been proposed to address these challenges. These include the development of clear and transparent career progression pathways, the promotion of diversity and gender equality, the promotion of professional development opportunities and training, and the creation of a supportive research culture. The following paragraphs will summarise the literature assessed as relevant for the SECURE project.

Key policy developments and Research Career Frameworks

The following paragraphs are predominantly referring to documents published by the EC and the Council of Europe. Recent developments and implementations of RCFs in Europe have aimed to address the growing need of better support and career opportunities for researchers at different stages of their careers. The main policy development for improving the working conditions of researchers is described in the **European Charter for**

Researchers and Code of Conduct for the Recruitment of Researchers[9]. The document primarily focuses on the improvement of working conditions and career development of researchers, providing principles and guidelines detailing the responsibilities and requirements for researchers and employers during recruitment, and career development and progression. The EC incentives the implementation of the Charter and Code principles by awarding institutions with the HR Excellence in Research (HRS4R) award. To this date, 1428 organisations have endorsed the Charter and Code, and 696 organisations have received the HRS4R award[10]. Current work on updating and revising the Charter and Code will include new principles and requirements considering more recent developments such as Open Science and gender equality as well as broadening the focus to careers outside academia and strengthening the links between research and innovation[11].

Political guidance for the Charter and Code initiative has been provided through council conclusions and recommendations. The **Council Conclusions on the Future Governance of the European Research Area**[12] highlights the importance of research and innovation for a thriving economy and environmental sustainability that should define the priorities and actions of the European Union (EU). The document lists insufficient funding, lack of coordination and collaboration between the various stakeholders, and the need for a more gender-balanced and diverse work force as main challenges that need to be overcome. Moreover, 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"**[13] recognises the needs for the improvement of research career opportunities and suggests a transparent and merit-based recruitment and career progression process, the promotion of science, and the need to better foster collaboration between academia and industry expanding research career opportunities. Additional focus to harmonise efforts and actions across the EU related to the improvement of research careers and to implement policy coordination and monitoring mechanisms is given by the **Council Recommendation on a Pact for Research and Innovation in Europe**[14].

The above-mentioned topics fall under the overall strategy for the new ERA for research and innovation described in the **Commission Communication on a European Skills Agenda for Sustainable Competitiveness, Social Fairness, and Resilience**[15]**.** The greater objective is to build a more sustainable and resilient future for Europe and addressing the societal challenges and global issues through the enhancement of Europe's scientific and technological excellence. On a more specific level, the **Commission Communication on a European Strategy for Universities**[16] encourages universities to support researchers in their professional development through training, mentoring, and networking opportunities, and to provide a clear and transparent career path for researchers allowing "*flexible and attractive academic careers, valuing teaching, research, entrepreneurship, management and leadership activities*".

Already in 2011, the EC presented several key challenges and recommendations in their document **Towards a European Framework for Research Careers**[17], especially reflecting on insufficient investment in research and its negative impact on funding available to researchers as well as the lack of career development opportunities for

[9] European Commission. European Charter for Researchers and Code of Conduct for the Recruitment of Researchers (2005) - https://euraxess.ec.europa.eu/sites/default/files/am509774cee_en_e4.pdf
[10] https://euraxess.ec.europa.eu/jobs/hrs4r
[11] European Commission. Technical Document on a European Framework for Research Careers. Unpublished document for ERAC Plenary Meeting in February 2023 (2023)
[12] Council of the European Union. Council conclusions on the Future Governance of the European Research Area (2021)
[13] Council of the European Union. Council conclusions on "Deepening the European Research Area: Providing researchers with attractive and sustainable careers and working conditions and making brain circulation a reality" (2021)
[14] Council of the European Union. Council Recommendation on a Pact for Research and Innovation in Europe (2021)
[15] European Commission. Commission Communication on a European Skills Agenda for Sustainable Competitiveness, Social Fairness, and Resilience (2020)
[16] European Commission. Commission Communication on a European Strategy for Universities (2022)
[17] European Commission. Towards a European Framework for Research Careers (2011)

(early-career) researchers. Limited mobility opportunities to different countries and sectors as well as inadequate recognition of non-academic career paths are further aspects mentioned. As a consequence, the **European Framework for Research Careers (EFRC)** was issued as a tool to promote the harmonization of research careers in Europe and improve mobility. The framework defines 4 levels of research career stages (R1-R4) and the required skills expected to be attained, it addresses all researchers and is independent of the sector they work in[18]. The most recent policy development from the beginning of 2023 and still in progress is reflected in the **technical document on a European framework for research careers[19]** by the EU's strategic policy advisory committee on topics related to research and innovation within the ERA. This note builds on the advice given in the previously mentioned publications and is developed in parallel to the revision of the Charter and Code. One focus of the EFRC is the connection between research career and innovation and entrepreneurship. The framework consists of 8 pillars to which later sections in the document will directly or indirectly refer. The pillars are set up to define the role of researchers in the ERA, and other professions (Pillar 1), to recognise the research profession, including their interoperability and comparability (Pillar 2), to address the recruitment and working conditions (Pillar 3), to enhance the skillset and training of researchers for inter-sectoral and inter-disciplinary careers and for entrepreneurship and innovation (Pillar 4), to improve programmes and concepts related to career development and progression (Pillar 5), to contribute to a balanced circulation of talents and to attract more researcher to Europe (Pillar 6), to support actions for research careers (Pillar 7), and to implement a monitoring system of research careers among others to provide researchers a clearer vision of the challenges and opportunities in the ERA (Pillar 8). To best align with the current political vision and policy developments related to ERA 4, this document will play a crucial role for the SECURE project.

Another important policy development is the detailed analysis of researchers' mobility which has been outlined in the **Knowledge ecosystems in the new ERA: Talent circulation and intersectoral mobility: analytical report with a mapping of talent mobility and causes of brain drain[20].** One main recommendation, apart from improving the mobility across countries and sectors, stressed the need for more systematic data in order to better inform evidence-based policy. This request is largely met by the **MORE2 and MORE4[21] studies** that "*provide internationally comparable data, indicators and analysis in order to support further evidence-based policy development on the research profession at European and national level*" and outline some policy implications[22]. Another important policy development linked to researcher assessment, and therefore recruitment and career development, is the **Evaluation of research careers fully acknowledging Open Science practices (OS-CAM)[23].** The OS-CAM is a multi-dimensional assessment framework guiding research-performing and research-funding organisations to evaluate researchers equally and independently of their background and especially according to their use of and contributions to Open Science[24].

The comprehensive OECD report on **Reducing the precarity of academic research careers**[25] offers a clear overview of the precarious situation of postdoctoral researchers in temporary positions and no prospects of permanent or continuous employment. This report explores challenges and how they are being perceived and addressed in different countries. The study reveals much commonality but also diversity across countries and among different stakeholders. It proposes a policy toolkit based on nine recommendations:

[18] https://euraxess.ec.europa.eu/europe/career-development/training-researchers/research-profiles-descriptors
[19] European Commission. Technical Document on a European Framework for Research Careers. Unpublished document for ERAC Plenary Meeting in February 2023 (2023)
[20] European Commission. Knowledge ecosystems in the new ERA: Talent circulation and intersectoral mobility : analytical report with a mapping of talent mobility and causes of brain drain (2022)
[21] https://www.more-4.eu
[22] Consult IDEA. Support for continued data collection and analysis concerning mobility patterns and career paths of researchers (2013)
[23] European Commission. Evaluation of research careers fully acknowledging Open Science practices (2013)
[24] SECURE's sister project OPUS is focusing on indicators, metrics, and interventions to promote Open Science.
[25] OECD. Reducing the precarity of academic research careers (2021) - https://doi.org/10.1787/0f8bd468-en

1. Improve the working conditions and offer more transparent, predictable, and flexible career prospects for postdoctoral researchers.
2. Offer broad professional development during postdoctoral training.
3. Promote equal opportunities, diversity, and inclusion in research careers by identifying and addressing existing biases and challenges.
4. Establish better links between research assessment, funding, and human resource management policy objectives.
5. Improve institutional practices regarding human resource management in research.
6. Promote the intersectoral mobility of researchers.
7. Support the international mobility of researchers (e.g., 26).
8. Develop the evidence base on research careers.
9. Include all relevant stakeholders in the governance and coordination of research careers and ensure concerted, systemic action.

The UNESCO **Recommendation on Science and Scientific Researchers**[27] aims at setting a universal standard and supports countries to create conditions that improve the working conditions of all scientific researchers, support staff (including technicians and students that support and contribute to research and development), as well as individuals involved in other aspects of science (such as science education, science communication, regulation and policy, funding, recruitment, etc.). And provides together with a set of international guidelines a means to measure progress. The document provides recommendations on main aspects related to research and development addressing. Most relevant for SECURE are the recommendations on the conditions for success on the part of scientific researchers, which include:

- Adequate career development prospects and facilities and Lifelong learning;
- Mobility, Participation in the international scientific and technological community;
- Protection of health and social security;
- Performance appraisal, expression by publication;
- Recognition;
- Reasonable flexibility in the interpretation and application of texts setting out the terms and conditions of employment of scientific researchers;
- The advancement of their various interests by scientific researchers in association

Several other stakeholders have also developed RCFs. One of them is the **Vitae Researcher Development Framework (RDF)**[28], which provides guidance for the personal, professional, and career development of researchers at all career stages. The framework is built around 4 domains covering knowledge and intellectual abilities, personal effectiveness, research governance and organisation, and engagement, influence, and impact. On the one hand, it recommends institutions to recognise the value of diverse career paths, and also stresses the importance of creating a supportive environment. On the other hand, it also stresses the significance of interdisciplinarity and the broader dissemination of research outputs for maximum impact. the RDF has been recognised as a comprehensive (online) tool, despite some concerns (also acknowledged by Vitae themselves)

[26] The Academic Careers Observatory (ACO) provides info on academic careers by country, discipline and theme aiming at facilitating researcher mobility - https://www.eui.eu/en/academic-units/max-weber-programme-for-postdoctoral-studies/aco-academic-careers-observatory

[27] UNESCO. Recommendation on Science and Scientific Researchers. Annex II Recommendation on Science and Scientific Researchers (2017) - https://unesdoc.unesco.org/ark:/48223/pf0000260889

[28] Vitae. Researcher Development Framework (2011)

about the utility, accessibility, and usage of the RDF. In this context, modifications could it more applicable for the requirements at different career stages[29].

Another framework which has been developed by the Irish University Association (IUA) is the **Researcher Career Framework[30]**. This framework covers the commonly known four main career stages from early-career to leading researcher (R1-R4) and includes relevant competencies associated with each stage. In this context, mentoring, training, and career development programmes are mentioned as best practices for institutions to support researchers in their careers.

A common remark towards both of the preceding initiatives is the lack of institutional support and the need to ensure proper implementation, e.g., through incorporation into institutional policies and strategies. A possible guidance is provided in the **Concordat to Support the Career Development of Researchers/the Researcher Development Concordat[31]** with already over a hundred organisational signatories. The concordat acknowledges the need for a standardised research development strategy across the UK. Overall, the concordat aims at supporting the creation of a supportive work environment for researchers and proposes best practices to support institutions in realising this.

Insights on research careers from stakeholder position statements and reports

Another important source of information about the requirements related to research careers are position statements published by researcher and university associations.

In their statement **The EU's emerging Pact for Research and Innovation should meet the expectations of the research sector[32]**, the Guild of European Research-intensive Universities provides some critical recommendations in order to strengthen Europe's research in the context of the renewed ERA. They see the need "*to re-articulate what a renewed, more ambitious and forward-looking ERA could achieve and to engage in a genuine co-creation with research stakeholder*". There are three main elements that the new ERA Pact for Research and Innovation should consider. First, the adoption of "*effective measures to boost Europe's position as a scientific powerhouse and its capacities for research excellence in all Member States* […] *through sufficient base-funding",* especially for bottom-up fundamental research. Second, "the *needs and concerns of the academic community as a starting point for designing more attractive research careers*", more concretely on the one hand ERA solutions should be coupled with programmes such as ERC and MSCA that can provide attractive working conditions and on the other a thorough discussion and consultation with the academic community to achieve a consensus regarding the definition of excellence in research. Third, a "*genuine dialogue"* between representatives of key research actors and the EU institutions particularly to increase awareness of the ERA strategies among research communities in Europe since this is a pre-requisite to ensure effective implementation.

In 2018, the League of European Research Universities (LERU) published their vision on the need and requirements of multiple career pathways for researchers in **Delivering talent: Careers of researchers inside and outside academia**[33]. The document presents good practice examples from member organisations of how support for the careers of researchers could look like and concludes with the following 7 recommendations: "*1) Researchers should be trained for a multitude of roles in society* [..] *2) A shift of perspective is required: from a straight career track to multiple career pathways,* [..] *3) The mechanisms by which early-stage researchers find their way from academia into society need to be strengthened,* [..] *4) More cross-sector mobility at senior levels should be achieved,* [..] *5) More effort is needed to accelerate progress of women in senior and leadership*

[29] Bray and Boon. Towards a framework for research career development: An evaluation of the UK's Vitae Researcher Development Framework (2013)

[30] Irish University Association (IUA). Researcher Career Framework (2020) - https://www.iua.ie/for-researchers/researcher-career-framework/

[31] Vitae. Concordat to Support the Career Development of Researchers/the Researcher Development Concordat (2019)

[32] The Guild. The EU's emerging Pact for Research and Innovation should meet the expectations of the research sector (2021)

[33] LERU. Delivering talent: Careers of researchers inside and outside academia (2018)

positions, and to enlarge diversity ambitions, [..] *6) Universities and supervisors have to strengthen career support,* [..] *7) Research stakeholders must engage together in supporting careers of researchers"*. In another statement titled **A Pathway towards Multidimensional Academic Careers - A LERU Framework for the Assessment of Researchers**[34], LERU addresses the over-reliance on bibliometrics in the assessment of researchers and proposes a set of different dimensions to better reflect various aspects of the researcher's work, including research output, impact, leadership, and professional development. The paper also suggests measuring methods to ensure fair and transparent assessment considering the diversity of researchers and their different career stages.

Such a Rethinking [of] **Academic Careers**[35], has also been elaborated in the Young European Research Universities Network's (YERUN) position statement, and in Science Europe's **Research Culture - Empowering Researchers with a Thriving Research System**[36]. Both organisations call for a cultural change by committing to revise the research career assessment and to create a more stability and sustainability in European research. YERUN further provides a set of case studies from member universities for university-level reforms to improve academic careers. In this context it should be noted that creating an assessment framework is complex and difficult, as it needs to balance between the standardisation and distinguishing different levels and acknowledging disciplinary diversity and requires involvement from and alignment between all stakeholders[37].

In line with the above, the European University Association (EUA) presents in their position paper **European Research Area: How to mobilise research-based knowledge for a better and more sustainable future**[38] a set of recommendations in order to support the new ERA. The document points out the key role of universities in Europe's research and innovation ecosystem. EUA is determined to be part of the collaborative approach that is required to create the conditions for strong and successful ERA that benefits society. In order to build the necessary conditions, EUA asks to:

1. Provide ambitious support to research and innovation.
2. Invest in both curiosity-driven and mission-oriented research and innovation for the benefit of society.
3. Place values at the core.
4. Promote multi-level governance for a more efficient ERA.
5. Shape an ERA that is open to the world.
6. Promote open science.
7. Encourage diversity.
8. Facilitate partnership and collaboration.
9. Encourage public engagement.
10. Value all disciplines.
11. Foster talent with attractive career structures.

Researcher organisations such as the International Consortium of Research Staff Associations (ICoRSA), Eurodoc, and the Marie Curie Alumni Association (MCAA) also focus on ensuring more sustainable research careers. ICoRSA states in their **Position Statement on sustainability of research careers and precarity**[39] that the high level of precarity is caused by uncertainty due to short-term contracts and the lack of career progression opportunities, which have devastating effects on researcher's wellbeing and the diversity among researchers. ICoRSA proposes core governmental funding as a solution to overcome precarity and ensure sustainable careers in academia,

[34] LERU. A Pathway towards Multidimensional Academic Careers - A LERU Framework for the Assessment of Researchers (2022)
[35] YERUN. Rethinking academic careers (2022)
[36] Science Europe. Research Culture - Empowering Researchers with a Thriving Research System (2021)
[37] Vorobieva and Teleshova. Research activities in the European qualifications system: Experience and problems (2018)
[38] European University Association (EUA). European Research Area: How to mobilise research-based knowledge for a better and more sustainable future (2020)
[39] ICoRSA. Position Statement on sustainability of research careers and precarity (2022)

instead of limited funding linked to the timeline of a project, and in general more funding options that enhance intersectoral mobility.

Eurodoc and MCAA identify four Challenges and Recommendations that all stakeholders of European research should consider, especially universities and research funders. In their joint **Declaration on Sustainable Research**[40], they stress the urgency to change the European system in order to prevent losing even more scientists. The challenges and respective recommendations are the following:

- *"Challenge 1 - Career Prospects and Research Funding:* [...] *researchers whose performance is evaluated as excellent early in their career, are not necessarily offered long-term employment in science"*. The *Recommendation* to overcome this, is to provide more stability and predictability through the creation of more permanent academic research positions, this needs to be supported by adequate research funding mechanisms.
- *"Challenge 2 - Career Management Support:* […] *the current highly competitive research funding landscape and the dire job prospects in academia are key factors for early career researchers to develop mental health problems"*. A proposed *Recommendation* is to deploy career management services at organisations employing researchers that provide suitable support and mentoring programmes.
- *"Challenge 3 - Transferable Skills Training and Recognition:* […] *the majority of researchers leave academia and find employment in other sectors. There, they often encounter as mismatch between their skill sets and non-academic job requirements, because universities typically train researchers mainly for an academic type of career"*. According to the *Recommendation* from Eurodoc and MCAA organisations should put more effort in the training of transferable skills. They also acknowledge that developing transferable skills requires investment from both the individual and the organization.
- *"Challenge 4 - Networking:* […] *researchers are highly focussed* [often working for several years] *on a very specific topic* [...] *and mostly within a single institution.* [While] *academic settings typically provide frequent inside-academia networking opportunities* […] *building meaningful networks outside academia still all too often depends on individual proactivity".* The *Recommendation* is to better prepare researchers for inter- and intra-sectoral mobility through adequate initiatives and programmes which further contribute to long-term, strategic partnerships between the academia and the non-academic sector.

<u>Reports and studies for the EC provided by third parties</u>

Various reports from third parties also provide relevant information, data, and further guidance for the development of an RCF. For instance, in the project MORE[41], the European Commission has collected data on the mobility patterns and career paths of EU researchers. The **MORE2 project** provided support for continued data collection and analysis concerning mobility patterns and career paths of researchers. Similarly, the **MORE4 study**[42] has updated, improved and further developed the set of indicators defined in previous MORE studies. Through the MORE projects, the European Commission has investigated which aspects researchers find important in their careers and evaluated the extent to which policy measures have affected these aspects. Building on the evidence presented in the MORE2 and MORE4 studies, the report on **Precarious careers in Research. Analysis and Policy Options**[43] identified the most vulnerable researcher groups and analysed in detail the factors most likely contributing to precarity by mapping employment contracts and career models. The report proposes a two-step process for a policy framework aimed at reducing the precariousness of research careers: 1) establishing a

[40] Eurodoc & MCAA. Declaration on Sustainable Researcher Careers (2019)
[41] Publications accessible in the policy library of Euraxess - https://www.euraxess.be/useful-information/policy-library
[42] European Commission. MORE4 study: Support data collection and analysis concerning mobility patterns and career paths of researchers (2021)
[43] WIFO Studies. Precarious careers in Research. Analysis and Policy Options (2022)

balance between the supply of qualified researchers seeking a career in research and the demand side providing stable career paths and 2) improving the working conditions through full-time employment contracts, appropriate salary, and compliance with ethical standards. Finally, the report suggests indicators to monitor progress.

Research careers in Europe[44] a study prepared for the EC by the Public Policy and Management Institute (PPMI), INOVA+ and CARSA evaluated three topics associated with research careers to improve the implementation of the Horizon 2020 Marie Skłodowska-Curie actions (MSCA). Their analysis of 1) research career promotion, 2) dual careers options in research, and 3) possibilities of restarting a research career in Europe after a break were based on survey data from 3,904 individual researchers, 1,572 representatives of research organisations, and several national stakeholders. Their recommendations range from specific topics related to MSCA to more general aspects, such as improvement of financial conditions, possibilities of managing a healthy work-life balance, awareness and further analysis of dual career issues, the need for greater acceptance of career breaks on the one hand and more research positions and long-term contracts to prevent career breaks on the other, as well as more flexible working arrangements.

The **DANUBIUS-RI strategy on Human Resources for Researchers**[45] followed up on the MORE2 project, which studied how researcher opportunities vary across the 4 R levels (i.e., graduate student, postdoc of different seniority, and research senior) and across member countries. The report has been prepared under the DANUBIUS-PP, a Flagship Project of the EU Strategy for the Danube Region, to support the DANUBIUS-RI in terms of legal, financial, and technical needs to become a successful pan-European distributed Research Infrastructure (RI). The project investigated in the report challenges and gaps of HR strategies that impact career structure, renumeration and mobility. This included data on salaries, mobility, and overall benefits, including the transferability of grants and pension rights affecting the mobility of researchers. The study is closely linked to the HRS4R tool mentioned earlier and recommends sharing of best practices among European Research Infrastructure Consortia (ERICs).

Lastly, several recent publications on the topic of research careers have reflected critically on the position of individual researchers and the system as such. Despite national differences, most ECRs share the same fate: many researchers are simply forced out into more stable non-research positions (e.g., 46) and those who stay are challenged by the increasing pressure and demands focusing more on securing funding than doing actual research[47]. The author of a critical article concludes that the current research system is inoperable because it tries to combine the incompatible structures of a basic science institution with those of a corporate business[48]. Changes to the existing systems, however, need to be carefully thought through, as the recent debate around a controversial Berlin law showed. The law was initially intended to improve the situation of Postdocs in Berlin requiring universities to offer newly hired postdocs a pathway to permanent positions. Some have warned, however, of unintended effects of a 'poorly executed' law that may lead to potential hiring freezes and overall negative consequences on research[49].

3.3 Main Points for further Analysis and suggested Input for WP2/3/4

Chapter 3 summarises the current state-of-the-art of RCFs in Europe. Some of the cited literature will be further discussed in the following chapters with regard to specific aspects of research careers, such as recruitment and working conditions, career development and progression, and the mobility of researchers. The main outcome of

[44] European Commission. Research careers in Europe (2016)
[45] DANUBIUS-PP. DANUBIUS-RI strategy on Human Resources for Researchers (2016)
[46] Kendall Powel. The future of the postdoc (2015)
[47] Nature. The plight of young scientists (2016)
[48] Lazebnik. Are scientists a workforce? - Or, how Dr. Frankenstein made biomedical research sick (2015)
[49] Vogel. Controversial Berlin law gives postdocs pathway to permanent jobs (2021) - https://www.science.org/content/article/controversial-berlin-law-gives-postdocs-pathway-permanent-jobs

the review shows that despite many potentially useful concepts, a successful implementation is lacking. The following main conclusions and recommendations have been identified which should be considered when developing the RCF in WP2:

- The SECURE RCF should build on the work that has been provided in many studies and reports and follow the guiding principles of key policy developments, including transparency, merit-based research career systems across Europe, gender equality, and Open Science. The RCF should build on existing frameworks and needs to be flexible enough to be applicable within and across institutions.
- The SECURE RCF should include a multi-level approach with a clear description of expected skills and competencies, as well as responsibility and leadership roles (referring to R1-R4). The RCF should further include the different career stages, e.g., recruitment and tenure, and mobility and should be flexible enough to address country-specific systems. The issue of appropriate funding strategies is of particular importance and should also be addressed.
- The SECURE RCF should build on existing frameworks while developing a new and unique framework that allows alignment with institutional practices and policies. The RCF should be aligned with the proposal of TTL models developed in parallel in WP3 offering options of structural measures to institutions that can support the implementation of the RCF.
- To ensure effectiveness, the RCF needs to align with the new EFRC currently developed by the EC and connect to its eight relevant pillars. In turn, the EFRC should provide strategic input and structural guidance for the development of the RCF.

Based on the literature review, extensive input has been collected to develop a first draft of an RCF. The EFRC will play a pivotal role in the development of the RCF and the RCF will aim at implementing components of the EFRC. The draft framework will then be further developed based on feedback from the pilots of selected aspects of the framework and a public consultation with key stakeholders and the wider research community. Finally, all of the feedback will be synthesised and incorporated into a final proposal for the RCF.

4. Recruitment and Employment Conditions for Researchers

This section presents the results of the conducted literature review to establish the state-of-the-art in recruitment and employment conditions for researchers. The objective of the review performed on the employment conditions for researchers was focused on obtaining data on how countries are performing and what types of barriers and gaps have been identified. As a core document we examined the Charter and Code[50] supplemented this with documents focusing on individual countries and institutions. The presented review seeks answers to the overall research question: "***How well are recruitment and employment conditions aligned to the Charter and Code and what are the barriers in aligning Institutional performance to the Charter and Code***". The full list of articles reviewed is available in Annex 2 – Articles Reviewed for Recruitment and Employment Conditions for Researchers.

4.1 Methodology and Overview of Search Results

The literature review on the sub-topic "recruitment and employment conditions in academia" was conducted as desk research of relevant literature of interest to SECURE. The aim was to identify main barriers and best practices related to employment and retainment of researchers in academia, which led us to base our search on key words such as "recruitment conditions" and "employment conditions". The methodology applied for the search and selection of key publications followed the Overall Methodology for Literature Review described in Chapter 2.

Step 1 *- Identify relevant key terms specific for the literature search on "recruitment and employment conditions for researchers" in Scopus.*

The following specific search terms were identified for the search related to "recruitment and employment conditions for researchers":

- Recruit*
- Employ*
- Condition*

Steps 2 - 4 *– Combine the specific and common sets of search terms for the search in the Scopus database and choose the publication year of 2000 as cut-off date.*

The search included a combination of the sub-task specific search terms mentioned under step 1 and the common set of search term combinations (as detailed in Chapter 2) to produce 6050 hits as in Table 4.1.

Table 4.1 Results of Search Term Combinations in Scopus

Specific Search Terms for Recruitment and Employment Conditions for Researchers	AND Common Search Terms and Combinations	Number of Hits
Recruit* OR Employ* OR Condition*	"research* assess*" OR "research* eval*" OR "scien* assess*" OR "scien* eval*" OR "academ* assess*" OR "academ* eval*"	4413

[50] European Commission. European Charter for Researchers and Code of Conduct for the Recruitment of Researchers (2005) - https://euraxess.ec.europa.eu/sites/default/files/am509774cee_en_e4.pdf

	"research* career*" OR "scien* career*" OR "academ* career*"	1624
	"career framework*"	27
Total		6050

Steps 5 - 8 *– Combine Scopus extracts, eliminated duplicates and assess the relevance of the article according to the titles and further confirm relevance by scanning the abstracts. Compile a final list of articles from the Scopus search and complement with additional key literature previously identified.*

After merging all results into a single spreadsheet and removing any duplicates, the list was reduced to 6004. The titles were checked, and 130 documents were then selected as potentially relevant literature for SECURE. Abstracts of these publications were screened in a next step, leading to a selection of 15 most relevant publications. The three publications most relevant for the recruitment and employment conditions for researchers were selected from the core list and included in the final list giving 18 articles to be reviewed in detail as shown in Table 4.2. The final list of the 18 articles reviewed is available in Annex 2 – Articles Reviewed for Recruitment and Employment Conditions for Researchers.

Table 4.2 Number of Key Articles remaining after Screening and Final List

Scopus Search Results	Duplicate Articles Removed	Articles Remaining After Screening	Extra Articles Added	Critical Articles Reviewed (Final List)
6050	6004	15	3	18

This list of key articles on the topic may not be fully complete. Building on this initial literature review, SECURE will ensure complementarity and community feedback through further engagement with the literature, interactions with project partners, and interactions with members of the project advisory board.

4.2 Overview on Recruitment and employment Conditions for researchers

The EU is basing their requirements, recruitment processes, and employment conditions on the Charter and Code and is aiming to harmonise diverging working conditions and career development opportunities for researchers across member states due to differences in national policies and regulations. The Charter and Code consists of a set of general guiding principles and requirements that every employer or funder should apply when recruiting researchers, ensuring transparency of the process and equal treatment of the applicants:

- Transparency
- Judging merit
- Acknowledgment of variations in the chronological order of CVs
- Recognition of mobility experience
- Recognition of qualifications

In particular, on the basis of these general principles and requirements, recruitment procedures should be open, effective, transparent, encouraging, internationally comparable and suitable for the jobs proposed. Selection committees should include members with different backgrounds and skills, represent an appropriate balance between men and women and, where necessary and possible, include members from various sectors (public and private), disciplines, and countries and with the experience needed to evaluate applicants. The evaluation of merit should take into account all the experiences matured by the applicants, their creativity and their degree of independence. Merit should be assessed on a qualitative and quantitative level, with the emphasis on any exceptional results obtained in a diversified personal career path and not exclusively on the number of

publications. Any experience of mobility, study visits in different countries or in other research institutes, or a change of discipline or sector, should be considered valuable contributions to the professional development of the researcher[51].

The EC has recognised that mobility of researchers (geographical, intersectoral, and interdisciplinary) is a core dimension of the new ERA encouraged member states to strive for brain circulation. Researcher mobility is generally seen as a key element of career development for ECRs and eventually better remuneration and employment conditions. There is a discrepancy among member states and associated countries with regard to the mobility of researchers and brain circulation, and the EC has proposed that schemes for the promotion of mobility and career development at European level should be supported, especially measures that will support researchers to return to their country of origin[52]. According to the **Position statement** [by ICoRSA] **on sustainability of research careers and precarity**[53], precarity is mainly correlated to short-term contracts, resulting in (i) low engagement by researchers (on all levels) in research career policy creation and with policymakers (ii) low researcher productivity due to researcher disillusionment and (iii) low project productivity. To overcome such deteriorating employment conditions, ICoRSA has proposed as a solution an increase in core governmental funding for researchers, a reorganisation of research funding to supporting long-term employment, core funding to universities for permanent positions, increase of funding for mobility.

The literature review will focus on examples from three European countries due to the limited data available for other European countries and based on the relevance of the European context for SECURE.

<u>Italy</u>

The literature review identified many barriers as well as good examples of researcher employment. Several examples are available from Italy to remove biases during the recruitment of researchers.

- The recruitment and advancement of professors is regulated by laws, which are overseen by the Italian Ministry of Education and Merit. There is a double evaluation procedure for the selection of associate and full professors in place. The first stage involves national prequalification for the candidates, which is managed directly by the ministry. The second stage of evaluations is managed by the individual universities, who then choose the prequalified individuals best suited to the specific needs of each institution. All candidates are assessed based on the examination of their documented qualifications, and a selection of winning candidates is between the two top ranked ones. The university announcing the competition is then allowed to hire one of the two top candidates. An analysis of bias during this process has shown that "*among candidates affected by negative bias, the incidence of female candidates is lower than that of male candidates. No gender differences occur among candidates who benefitted from positive bias"* but for the male candidates, *"the number of the applicant's career years in the same university as the committee members and the agreement between the gender of the applicant and that of the committee president assume greater weights in the judgment of competition outcomes than they do for the female applicants"*[54].
- To evaluate possible nepotism and favoritism during the recruitment process, Abramo et al., introduced a methodological approach to measure the effectiveness of recruitment and turnover of professors via a merit-based process. The basic idea is that university excellence will increase with recruitment of high

[51] European Commission. European Charter for Researchers and Code of Conduct for the Recruitment of Researchers (2005) - https://euraxess.ec.europa.eu/sites/default/files/am509774cee_en_e4.pdf

[52] Council of the EU. Council conclusions on "Deepening the European Research Area: Providing researchers with attractive and sustainable careers and working conditions and making brain circulation a reality" (2021) - https://www.consilium.europa.eu/media/49980/st09138-en21.pdf

[53] ICoRSA. Position Statement on sustainability of research careers and precarity (2022) - https://icorsa.org/wp-content/uploads/2022/09/Position-Statement-on-sustainability-of-research-careers-and-precarity_ICoRSA.pdf

[54] Abramo et al. Gender bias in academic recruitment (2016a)

performing applicants on the one hand and separation from less performing researchers on the other. Abramo and colleagues concluded that although "*there is no significant correlation between the effectiveness of recruitment and effectiveness of turnover",* Abramo suggested that *"*[t]*he application of such measures could also assist in incentivizing merit-based processes of recruitment and turnover, reducing phenomena of favouritism and nepotism"*[55]. Monitoring this turnover process over time and incorporating it into an incentive system could contribute to reduce cases of favouritism and nepotism.

- By 2020, Italian higher education had undergone two major reforms: 1) the marked increase in female representation in of academic staff and the implementation of market-based reforms aimed at fostering cost efficiency and economic productivity, resulting in reshaping the academic career ladder envisaged by the last university reform (Gelmini reform-law 240/2010) and 2) the adoption of a performance-based funding system. From 2010 to 2020, an analysis has been performed by the Ministry of Education, University, and Research's statistical office to collect data on changes in the system as a result of the reforms. An analysis of the available data concluded that the reforms are changing higher education recruitment and employment conditions, but "*the road to gender equality is extremely slow and non-linear. The introduction, with the Gelmini reform, of the new fixed-term assistant professor has tightened female access to the tenure track. Moreover, female recruitment remained substantially unchanged over the period among associate and full professors, thus suggesting that the feminization of the academic staff is not due to an effective improvement of gender equality in recruitment, but also to demographic dynamics, such as the retirement of men who are concentrated in the older cohorts*"[56].
- In 2021, another Italian national policy initiative created to contrast favouritism and foster recruitment effectiveness was analysed. It seems that national policies from the past 10 years have been negatively impacting researchers' performance, indicating a decline of both unproductive and high-performing recruits, and no overall improvement in the effectiveness of recruitment[57].

<u>Portugal</u>

An analysis of the education system in Portugal, in terms of hiring process in relation to women at the beginning of their academic career, indicated that "*First, Portuguese higher education institutions reproduce the same inequalities in career structures that are dominant in other occupational spheres, with the same phenomena of horizontal and vertical segregation both in universities and polytechnics careers. Second, recruitment and selection processes have an important influence on women in academia with the use of informal procedures emerging as an obstacle for women entrance into academic careers*"[58]. Sousa and Magalhães[59] analysed the Charter and Code in the framework of the implementation of the ERA in Portugal showed that up until 2014, the trend of creating autonomous and sustainable research careers (as observed in European policies) has not been translated into national recruitment procedures and into the ethos of universities, research centres, polytechnics, and industry in Portugal.

<u>Germany</u>

An evaluation of hiring procedures in higher education in Germany in 2001 concluded that the system is outdated and a crucial element of the reorganisation of such a system is the redistribution of power in higher education. "*In the German case, it is likely that the most important arena for the future of higher education will be located in a bargaining structure situated between the emerging managerial class within the higher education and science*

[55] Abramo et al. A methodology to measure the effectiveness of academic recruitment and turnover (2016b)
[56] Gaiaschi and Musumeci. Just a matter of time? Women's career advancement in neo-liberal academia. An analysis of recruitment trends in Italian Universities (2020)
[57] Abramo and D'Angelo. Were the Italian policy reforms to contrast favoritism and foster effectiveness in faculty recruitment successful? (2021)
[58] Carvalho and Santiago. New challenges for women seeking an academic career: The hiring process in Portuguese higher education institutions (2010)
[59] Sousa and Magalhães. A research career? The Portuguese case (2014)

system and a strategy-oriented policy class within the state bureaucracy"[60]. The recruitment of scientists in academia is an important issue in higher education. There is research that suggests that decision makers in academia tend to prefer candidates whose demographic backgrounds are similar to their own[61]. To address this challenge, it was suggested that mentoring may improve recruitment practices, retention, and staff personal satisfaction. Mentors can guide ECRs in making science career choices and help them to expand the number of scientists entering the labour market[62].

4.3 Main Points for further Analysis and suggested Input for WP2/3/4

The outcomes of the literature review presented in this chapter reflect the general perception of the precarity of academic research careers voiced by various stakeholders. Despite country-specific structures, local regulations and policies (thus potentially challenging for a common research career framework) and different funding budgets and strategies, the problem of insecure and instable employment is prevalent and a number of common approaches were identified which could be applied to improve the recruitment and working conditions for researchers across Europe. The following recommendations are proposed to feed into the work of WP2, WP3, and WP4:

- Endorse the alignment of local laws and initiatives with the Charter and Code;
- Develop and strengthen local initiatives supporting the improvement of employment conditions and recruitment procedures;
- Address and ensure gender-equality during all stages of the researcher career;
- Use of mentorship programmes to prepare and guide ECRs through recruitment processes;
- Consider implementing a monitoring strategy to better understand the effect of tools for the effective recruitment and enhancement of working conditions.

[60] Enders. A chair system in transition: Appointments, promotions, and gate-keeping in German higher education. (2001)
[61] Roebken. Similarity attracts: An analysis of recruitment decisions in academia (2010)
[62] Bernice and Teixeira. Mentorship: A Successful Tool for Recruitment, Recognition, and Advancement (2002)

5. Career Development and Progression for Researchers

This section presents the results of the conducted literature review to establish the state of the art in career development and progression for researchers. The objective of the review was to identify challenges and gaps, as well as best practices in the literature that will inform the activities in WP2, WP3, and WP4 on interventions for career development and progression. The full list of articles reviewed is available in Annex 3 – Articles Reviewed for Career Development and Progression for Researchers.

5.1 Methodology and Overview of Search Results

Step 1 *- Identify relevant key terms specific for the literature search on "recruitment and employment conditions for researchers" in Scopus.*

The following specific search terms were identified for the search related to "recruitment and employment conditions for researchers":

- "career* develop*"
- "career* progress*"
- "career* advanc*"
- "career plan*"
- "career trajector*"
- "career support*"

Steps 2 - 4 *– Combine the specific and common sets of search terms for the search in the Scopus database and choose the publication year of 2000 as cut-off date.*

The search included a combination of the sub-task specific search terms mentioned in step 1 and the common set of search term combinations (as detailed in Chapter 2) to produce 1147 hits as in Table 5.1.

Table 5.1 Results of Search Term Combinations in Scopus

Specific Search Terms for Career Development and Progression for Researchers	AND Common Search Terms and Combinations	Number of Hits
"career* develop*" OR "career* progress*" OR "career* advanc*" OR "career plan*" OR "career trajector*" OR "career support*"	"research* assess*" OR "research* eval*" OR "scien* assess*" OR "scien* eval*" OR "academ* assess*" OR "academ* eval*"	69
	"research* career*" OR "scien* career*" OR "academ* career*"	1057
	"career framework*"	21
Total		1147

Steps 5 - 8 *– Combine Scopus extracts, eliminated duplicates and assess the relevance of the article according to the titles and further confirm relevance by scanning the abstracts. Compile a final list of articles from the Scopus search and complement with additional key literature previously identified.*

Consistent with the overall approach, the titles and abstracts of the original collection of 1113 documents were screened and 31 were selected, indicating a relevance to inform WP2, WP3 and WP4 on matters of career development and progression. Key findings and messages critically relevant for the scope of this chapter were

extracted from these 31 publications as in Table 5.2. The full list of the 31 articles reviewed is available in Annex 3 – Articles Reviewed for Career Development and Progression for Researchers.

Table 5.2 Number of Key Articles remaining after Screening and Final List

Scopus Search Results	Duplicate Articles Removed	Articles Remaining After Screening	Extra Articles Added	Critical Articles Reviewed (Final List)
1147	1113	31	0	31

This list of key articles on the topic may not be fully complete. Building on this literature review, SECURE will ensure complementarity and community feedback through further engagement with the literature, interactions with project partners, interactions with members of the project advisory board.

5.2 Overview on Career Development and Progression for Researchers

Scientific and grey literature on career development and progression is predominant in medical fields with much less discourse in other disciplines. Many insights transfer from the research environment in health sciences, but careers in those fields differ so strongly from Science, Technology, Engineering, and Mathematics (STEM) and Social Sciences and Humanities (SSH) fields that some systematic policies are not applicable outside medical and health research. Most of the found literature is based on subjective data, such as larger self-administered surveys and interviews with often only a very small sample size. Finally, some publications are solely the authors' individual perspectives and reflections. Rarely were surveys, interviews, or reflections paired with objective data. As such, more statistical data and monitoring would be needed to provide a reliable evidence base.

The aim of most of the found studies focused on improving the overall performance of the participating researchers in all aspects of their positions, and thus include comparable training, mentoring and career development interventions. The main focus of the studies was typically on doctoral candidates, while some also addressed postdoctoral researchers or students, thus demonstrating that such interventions are useful as early as possible and throughout all career stages. Below are the three main topics presented:

Mentoring

The reviewed literature aligned well about the importance of mentoring, with success heavily depending on the individual mentor and the personal relationship with the mentee. Despite this, only a few studies looked into the performance of the mentor, finding a need for systematic and mandatory training[63]. A large variety of innovative approaches to mentoring was reported, such as the involvement of multiple mentors, peer groups, and transregional networks, as well as a number of support measures, from theoretical frameworks to specific materials or exercises. A common component of mentoring schemes is the individual planning to tailor the specific activities and the training to the needs and goals of the individual mentee[64]. Shortcomings despite those measures were found to often be present for career goals outside academia, which has to be considered in holistic interventions or programmes for career progression[65].

Training

The literature regarding training interventions holds a large number of individual courses, such as lab management courses and formal career modules. Due to the diversity and number of these sources, the following

[63] Sood et al. Mentoring Early-Career Faculty Researchers Is Important - But First "train the Trainer" (2016)

[64] House et al. Mentoring as an intervention to promote gender equality in academic medicine: A systematic review (2021)

[65] Clair et al. The new normal: Adapting doctoral trainee career preparation for broad career paths in science (2017)

section focuses on examples of broader resources covering a multitude of topics, a structured programme or a literature overview in itself. Training in doctoral education is usually aligned with the prospective career path, for which the literature holds useful taxonomies of competencies to be covered[66] and collections from literature reviews with detailed recommendations[67]. Moreover, there are a number of reports from widely rolled-out training programmes, including feedback and evaluation of the training measures[68]. Few resources also highlight current approaches and strategies for professional learning and development of postdoctoral researchers, usually with a focus on academic career pathways[69]. Related to all career levels, there are several sources of literature that explicitly include career competencies, training for career planning, and specific career-related interventions[70]. Finally, only very few sources go beyond the assertation of an intervention's success and retrospectively evaluate the success during later stages along the career pathway or identify specific shortcomings in the training needs[71].

Policies

Most policy-related studies are concerned with gender equality, either directly addressing an underrepresentation of women or concerning indirect factors such as partnering policies and family friendliness, e.g., through part-time policies[72]. Beyond that, researcher mobility and migration were found to be strongly dependent on national and institutional policies, including a need for local policies against nepotism[73]. Major impacts are found nationally and institutionally, but several barriers need to be addressed at the European level[74]. A related area is multilingual publishing, as these practices are particularly impacted by institutional policies and the local incentives systems are often related to both career progression and employment policies[75]. Another aspect that can be addressed through policy interventions is the research culture within the institutions, particularly by implementing human resource strategies that foster good workplace culture and environments. Career development and progression are predominantly covered in local policies at the organisation level[76], but there is a need for harmonisation of career paths across Europe that has yet to be addressed[77]. Moreover, studies found that institutional policies, including the incentives and rewards systems put in place, often hinder or disincentivise interdisciplinary practices[78].

Many of the aforementioned points were the result of policy reforms across Europe in past years. Comparing, for example, policy reforms in France and Spain shows that the adoption of another institution's structure or policy (mimetic isomorphism) is much more effective than radical policy approaches where organizations must change as a function of external circumstances (coercive isomorphism)[79]. Further systemic limits for the impact of reforms remain in place, e.g., by favouritism despite meritocratic reforms[80]. Moreover, the interplay of self-interest, personal beliefs and the fact that systems to some degree always create their own support bases, means

[66] Barnes et al. Career Competencies for Academic Career Progression: Experiences of Academics at a South African University (2022)
[67] Chatzea. Recommendations for young researchers on how to better advance their scientific career: A systematic review (2022)
[68] Lenzi et al. The NIH "BEST" programs: Institutional programs, the program evaluation, and early data (2020)
[69] Rybarczyk et al. Postdoctoral training aligned with the academic professoriate (2011)
[70] Claydon et al. Building skill-sets, confidence, and interest for diverse scientific careers in the biological and biomedical sciences (2021)
[71] Crossouard. The (re-)positioning of the doctorate through the eyes of newly qualified researchers (2010)
[72] Ahmad. Family or Future in the Academy? (2017)
[73] Seeber et al. Exploring the effects of mobility and foreign nationality on internal career progression in universities (2022)
[74] Pieters and Schoukens. Improving the social security of internationally mobile researchers (2011)
[75] Ivancheva and Gourova. Challenges for career and mobility of researchers in Europe (2011)
[76] Baruch. Transforming careers: From linear to multidirectional career paths: Organizational and individual perspectives (2004)
[77] Kochen and Himmel. Academic careers in general practice: Scientific requirements in Europe (2000)
[78] Müller and Kaltenbrunner. Re-disciplining Academic Careers? Interdisciplinary Practice and Career Development in a Swedish Environmental Sciences Research Center (2019)
[79] Marini. Coercive and mimetic isomorphism as outcomes of authority reconfigurations in French and Spanish academic career systems (2021)
[80] Montes. Micropolitics and meritocracy: Improbable bed fellows? (2019)

that policy reforms need to consider the response of the scientific communities. Correspondingly, negotiated compromises do not necessarily produce the best uptake or the intended outcome of a policy reform[81].

5.3 Main Points for further Analysis and suggested Input for WP2/3/4

The recommendations and interventions found in the literature were well aligned, but so diverse in their details that it would not be fruitful to summarise them in this review. Instead, a selected overview is presented to inform WP2, WP3 and WP4.

Interventions suggested for WP2, WP3 and WP4 fall into the following 6 areas:

- Structured mentorship interventions should be implemented to augment and complement the mentoring by the individual supervisor. These can be designed by either reproducing existing mentorship interventions[82] or incorporating new individual, selected activities. Such selected components may include the writing of a dedicated mentoring plan based on the mentee's career goals, although the impact of these plans is discussed controversially in the literature, and highly relies on the individual attitudes of mentor and mentee, as well as their personal relationship. Other individual activities connected to mentorship may also include group mentoring or mentoring communities[83]. An important aspect in all of these measures is the training of the participating mentors to ensure the best possible outcomes for the mentees. Moreover, mentorship interventions may be coupled to the funding for the position or research, specifically in cases where the positions for doctoral candidates are managed by the university or research institute.
- Career planning interventions can be implemented as stand-alone measures, e.g., as a standard module in the accredited PhD programme or as other kinds of formalised courses[84]. Experienced Principal Investigators (PIs) can act as career coaches and provide added value if separate from mentors[85]. Alternative forms of career planning interventions are narrative career counselling, sponsoring programmes for enhanced career development, and other structured career advisory programmes[86]. In addition to top-down interventions, the literature provides a number of examples for peer-group interventions, such as career clubs or discussion and reflection spaces. External formats for career-related interventions include a young investigators' forum[87], mentoring-based conferences for career stimulation, and different forms of network-based mentoring approaches that foster career progression. All of these measures can be supported by suitable tools, such as the RDF, career scripts, milestones-based approaches, or a variety of online tools.
- Individual training interventions may be implemented in connection to mentorship and career interventions. These can include leadership courses, lab management courses or grant-writing training, as well as a variety of other measures selected from existing collections of training activities[88]. Moreover,

[81] Sanz-Menéndez and Cruz-Castro. University academics' preferences for hiring and promotion systems (2019)
[82] Brüggmann and Groneberg. An index to characterize female career promotion in academic medicine (2017)
[83] Smit and van den Berg. Assisted self-mentorship of a boundaryless research career (2016)
[84] Claydon et al. Building skill-sets, confidence, and interest for diverse scientific careers in the biological and biomedical sciences (2021)
[85] Byars-Winston. Integrating theory and practice to increase scientific workforce diversity: A framework for career development in graduate research training (2011)
[86] Miller et al. Full paper the career identity program: Creating a personalized academic-to-career plan for first-year engineering students (2018)
[87] Panettieri et al. Impact of a Respiratory Disease Young Investigators' Forum on the Career Development of Physician-Scientists (2020)
[88] Moore et al. Peer Multiple Mentor Model (P3M) for Training Disability/Health and Rehabilitation Equity Researchers: Case Study at a Historically Black College/University (2022)

some studies highlight the value of interventions at the research group or laboratory level in addition to courses offered at the university level[89].

- Interventions towards policies and regulations are particularly important in relation to the gender dimension. These interventions may include specific policies for partnering or family-friendly policies, such as specific part-time regulations. Generally, it is advisable to align HR policies in suitable ways to foster good research and collaboration culture at the level of the research team or lab. Further policy interventions should be directed towards internationalisation, in order to ensure meaningful mobility experiences[90]. Revising internal regulations should also foster the implementation of different career paths and be particularly aligned to foster and incentivise interdisciplinary research[91].
- Ideally, the four areas above in this list would be jointly implemented to form holistic programmes, e.g., including mentoring, training, and career planning[92] with personalised training interventions and parallel monitoring[93]. A discussion on critical elements to be included is available in multiple sources (e.g., 94). The implementation should ideally include a variety of settings, with virtual and in-person interventions, as well as on-demand components. Examples for such holistic programmes are given, such as the American Broadening Experiences in Scientific Training (BEST) programme[95] and the independent investigator incubator. Structured programmes with a holistic approach for career development and progression also exist for postdoctoral researchers (e.g., 96).
- Regarding career progression, specific emphasis should be given to indicators and metrics. Best practices can be adapted from the recruitment context regarding indicators and review panels. The indicators and metrics used in career progression have a specific importance also for monitoring the success of mentoring, training, and career development interventions[97]. For this, there are numerous new metrics and indicators, including for career progress and career success. Other novel evaluation approaches should also be considered, for example via a researcher portfolio or by including Artificial Intelligence (AI) solutions.

Finally, the literature highlights that all such interventions may be connected not just to institutional policies and regulations but can be particularly impactful if integrated into reforms of the funding system[98].

[89] Grinstein and Treister. The unhappy postdoc: A survey based study (2018)
[90] Cañibano et al. Scientific careers and the mobility of European researchers: an analysis of international mobility by career stage (2020)
[91] Begg et al. Approaches to preparing young scholars for careers in interdisciplinary team science (2014)
[92] Denton et al. Non-academic career pathways for engineering doctoral students: An evaluation of an NSF research traineeship program (2020)
[93] Farnese et al. Undergraduates' academic socialization. A cross-time analysis (2022)
[94] House et al. Mentoring as an intervention to promote gender equality in academic medicine: A systematic review (2021)
[95] Lenzi et al. The NIH "BEST" programs: Institutional programs, the program evaluation, and early data (2020)
[96] Rybarczyk et al. Postdoctoral training aligned with the academic professoriate (2011)
[97] Sorkness et al. A new approach to mentoring for research careers: The National Research Mentoring Network (2017)
[98] Brüggmann and Groneberg. An index to characterize female career promotion in academic medicine (2017)

6. Interinstitutional, Intersectoral, and International Mobility

This chapter outlines crucial aspects of researcher mobility based on the literature reviewed reflecting the state of the art in interinstitutional, intersectoral, and international mobility. The objective of the review was to describe the three different types of mobility and the outcomes of this chapter will directly feed into the activities in WP2, WP3, and WP4. The full list of articles reviewed is available in Annex 4 – Articles Reviewed for Interinstitutional, Intersectoral, and International Mobility.

6.1 Methodology and Overview of Search Results

As presented for the other chapters, the literature review on the sub-topic "interinstitutional, intersectoral and international mobility" followed the methodology described in the Overall Methodology for Literature Review described in Chapter 2 to identify relevant literature of interest to SECURE.

Step 1 *- Identify relevant key terms specific for the literature search on interinstitutional, intersectoral and international mobility" in Scopus.*

For this search, a single specific search term was selected for the search related to "interinstitutional, intersectoral, and international mobility":

- mobil*

Steps 2 - 4 *– Combine the specific and common sets of search terms for the search in the Scopus database and choose the publication year of 2000 as cut-off date.*

The search included a combination of the sub-task specific search term mentioned in step 1 and the common set of search term combinations (as detailed in Chapter 2) to produce 1187 hits as in Table 6.1.

Table 6.1 Results of Search Term Combinations in Scopus

Specific Search Terms for interinstitutional, intersectoral, and international mobility	AND Common Search Terms and Combinations	Number of Hits
mobil*	"research* assess*" OR "research* eval*" OR "scien* assess*" OR "scien* eval*" OR "academ* assess*" OR "academ* eval*"	635
	"research* career*" OR "scien* career*" OR "academ* career*"	537
	"career framework*"	15
Total		1187

Steps 5 - 8 *– Combine Scopus extracts, eliminated duplicates and assess the relevance of the article according to the titles and further confirm relevance by scanning the abstracts. Compile a final list of articles from the Scopus search and complement with additional key literature previously identified.*

Through merging and removing duplicates the initial list was shortened to 1166, out of which 134 were selected to be potentially relevant for SECURE. The selection process revealed 5 topics (International mobility, Gender perspective, Career choices in and outside academia, Interdisciplinarity and Intersectoral cooperation and mobility, and Career development inside academia) for which 19 articles were selected. The final list of 19 articles

was then complemented by 2 articles from the core list (see Table 6.2). The full list of the 21 articles reviewed is available in Annex 4 – Articles Reviewed for Interinstitutional, Intersectoral, and International Mobility.

Table 6.2 Number of Key Articles remaining after Screening and Final List

Scopus Search Results	Duplicate Articles Removed	Articles Remaining After Screening	Extra Articles Added	Critical Articles Reviewed (Final List)
1187	1166	19	2	21

This list of key articles on the topic may not be fully complete. Building on this initial literature review, SECURE will ensure complementarity and community feedback through further engagement with the literature, interactions with project partners, interactions with members of the project advisory board.

6.2 Overview on Interinstitutional, Intersectoral, and International Mobility

The three different types of mobility cover the following section refer to interinstitutional mobility as the mobility between different institutions of the same sector (e.g., between universities), intersectoral mobility as the mobility between sectors (e.g., academia, industry, non-profit sectors, public and government sector), and international mobility between countries. All articles report that academic "mobility" is generally considered a positive and even desirable element in public discourse[99]. This positive sense is especially strong for international and institutional mobility, as these forms of mobility are generally seen to expand the researchers' social capital, their transferable skills, and research network[100] [101] [102] [103].

Interinstitutional

The literature does not mention this type of mobility, it rather seems to be generally seen as mobility from less prestigious to more prestigious institutions[104] [105] or as arising from the need to find a new contract after the current one has expired. It seems thus to be strongly connected with short-term contracts and precarity [106] [107] [108] [109].

Intersectoral

Intersectoral mobility, e.g., moving from academia to industry, can be challenging. One article, more focused on US academia, notes that supervisors are generally not able to support their supervisees in gaining employment in non-research-intensive institutions or positions, due to their own lack of interaction with other types of institutions. This finding seems to be supported by the fact that "researchers" are often defined as an "academic

[99] Teichler. Academic mobility and migration: What we know and what we do not know (2015)
[100] Tovar. Fractured scientific subjectivities. International mobility as an option and obligation (2018)
[101] Cañibano et al. Scientific careers and the mobility of European researchers: an analysis of international mobility by career stage (2020)
[102] Oliver. Living flexibly? How Europe's science researchers manage mobility, fixed-term employment and life outside work (2012)
[103] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[104] Tovar. Fractured scientific subjectivities. International mobility as an option and obligation (2018)
[105] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[106] Oliver. Living flexibly? How Europe's science researchers manage mobility, fixed-term employment and life outside work (2012)
[107] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[108] Cañibano et al. Scientific careers and the mobility of European researchers: an analysis of international mobility by career stage (2020)
[109] Tovar. Fractured scientific subjectivities. International mobility as an option and obligation (2018)

elite" or even a "caste" [110]. Moreover, the findings suggest that mobility is most effective in promoting career development when it is strongly linked with the home institution[111], while "mobile researchers" seem to be considered by hosting institutions as "indispensable but temporary workforce" and non-proper human resources[112]. These considerations could partly explain why intersectoral mobility is still poorly considered as a viable career development option and as a potential resource for the development of academic networks outside the academic circles.

The scenario of intersectoral mobility may vary depending on the country. In 2009, Laura Cruz-Castro and Luis Sanz-Menéndez[113] wrote an article on "The employment of PhDs in firms: trajectories, mobility and innovation" specifically for Spain. They pointed out that about 55% of PhD students preferred the public sector, while 45% preferred private sector jobs. In 2015, Hanna Hottenrott and Cornelia Lawson[114] published an article on how home research groups are shaping researchers' career path in Germany. It was pointed out that in Germany, only 6% of research groups trained researchers for public jobs alone, while 31% reported that their departing researchers joined industry. It was also found that research groups that give high importance to joint publishing and patenting with industry have a higher probability of their researchers leaving academic to find employment in industry.

On the other hand, among all three types of 'triple i mobility', intersectoral mobility was the least considered option among researchers. According to the **MORE4 study[115]**, in 2019 only 23.8% of researchers (R2-R4) across the EU chose a career path involving intersectoral mobility. This varies to a certain degree between the different countries surveyed as in Figure 6-1. When it comes to intersectoral collaboration, it is only 32.2% for non-academic collaboration compared to 77.4%.

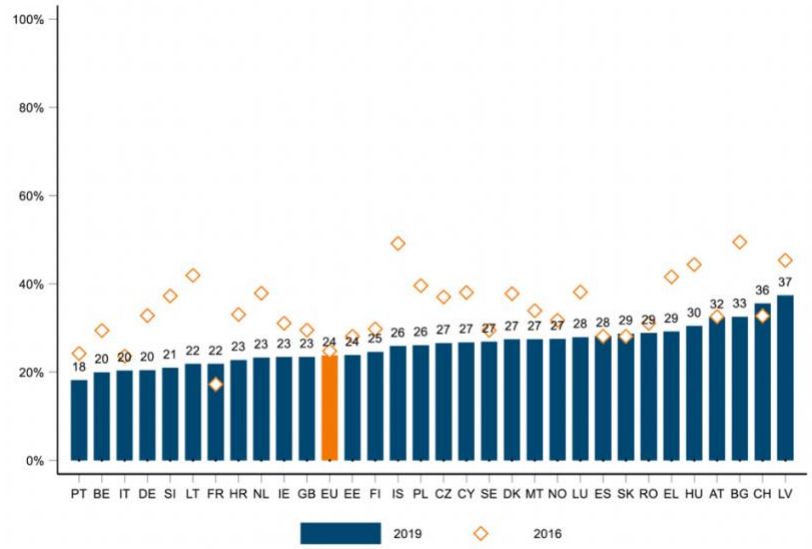

Figure 6-1 MORE4 EU HE Survey and MORE3 EU HE Survey (2016) (Source: MORE4 study: Support data collection and analysis concerning mobility patterns and career paths of researchers)

[110] Pinheiro et al. Take me where I want to go: Institutional prestige, advisor sponsorship, and academic career placement preferences (2017)
[111] Zabetta and Geuna. International postdoctoral mobility and career effect in Italian academia – 1986-2015 (2019)
[112] Oliver. Living flexibly? How Europe's science researchers manage mobility, fixed-term employment and life outside work (2012)
[113] Cruz-Castro and Sanz-Menéndez. The employment of PhDs in firms: Trajectories, mobility and innovation (2005)
[114] Hottenrott and Cornelia Lawson. Flying the nest: how the home department shapes researchers' career paths (2017)
[115] European Commission. MORE4 study: Support data collection and analysis concerning mobility patterns and career paths of researchers - Survey on researchers in European Higher Education Institutions (2020)

The recent study report on **Knowledge ecosystem in the new ERA: Talent Circulation and intersectoral mobility**[116] mentioned the main demand and supply side factors for intersectoral mobility. The demand side factors include a lack of absorptive capacity in industry, misconceptions, and lack of awareness about the value of a PhD, and a lack of structural links between academia and industry. The supply side factors include researchers' individual preference for academia, low recognition of intersectoral mobility in academia for evaluation or career progression, a lack of insight in own competences as well as adequate training for skills to prepare for a diverse career path, and a lack of overall availability of intersectoral mobility options for researchers.

International

In general discourse, "international mobility" is not well-defined, and encompasses a complex semantic field. Among the most frequently used sub-fields, there is "internationalisation" as a means of cultural exchange and building of cross-border mutual understanding, "internationalisation" as a means of economic and strategic competition among different centres of knowledge production, "internationalisation" as the physical mobility of researchers, and the personal life issues and administrative and organisational issues linked to it[117] [118] [119]. The conceptual link with keywords such as "precarity" and "young or early career researchers" (ECRs) seems to be active in all mentioned sub-fields, but especially with the last one, as international mobility seems to acquire another specific sub-meaning, as *"international mobility as a semi-forced activity for improving one's career development"*[120] [121].

This suggests that during the last decades, the nature, purposes, and challenges of international mobility have partially changed. It is thus necessary to draw a new scheme of definitions of "international mobility" and sub-categories which are better able to identify the nuances of the reality of this phenomenon. Variables that should be better isolated to properly frame the phenomenon are the length of the stay, the purpose of the stay, the contractual status of the mobile researcher, and the final outcome of the mobility process, both in reached career stage and final settlement choices[122]. The direction of international mobility should also be highlighted, as international mobility seems to be valued only if researchers move from peripheries to the centres of research production (USA, EU, discipline-specific centres), from less prestigious universities to more prestigious universities, and from less funded universities to more funded universities[123] [124] [125] [126].

Coming to the effects of international mobility, it seems that only some specific combinations of the previously listed elements seem to lead to positive effects on individual scientific productivity and career development, and on the success of universities/departments. Other factors linked with international mobility that influence career development are:

- Career stage[127],
- Prestige of the hosting institution[128] [129] [130] [131],

[116] European Commission. Knowledge ecosystems in the new ERA: Talent circulation and intersectoral (2022)
[117] Teichler. Academic mobility and migration: What we know and what we do not know (2015)
[118] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[119] Tovar. Fractured scientific subjectivities. International mobility as an option and obligation (2018)
[120] Oliver. Living flexibly? How Europe's science researchers manage mobility, fixed-term employment and life outside work (2012)
[121] Tovar. Fractured scientific subjectivities. International mobility as an option and obligation (2018)
[122] Teichler. Academic mobility and migration: What we know and what we do not know (2015)
[123] Oliver. Living flexibly? How Europe's science researchers manage mobility, fixed-term employment and life outside work (2012)
[124] Tovar. Fractured scientific subjectivities. International mobility as an option and obligation (2018)
[125] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[126] Cañibano et al. Scientific careers and the mobility of European researchers: an analysis of international mobility by career stage (2020)
[127] Cañibano et al. Scientific careers and the mobility of European researchers: an analysis of international mobility by career stage (2020)
[128] Tovar. Fractured scientific subjectivities. International mobility as an option and obligation (2018)
[129] Zabetta and Geuna. International postdoctoral mobility and career effect in Italian academia – 1986-2015 (2019)

- Width and prestige of the network(s) which the researcher is able to establish[132] [133] [134] [135],
- Personal skills of the researcher themselves[136],
- Ability of the mobile researcher to keep strong ties with their previous team and institution during their mobility period(s)[137] [138],
- Overall impact of mobility on an individual researcher's personal life, wellbeing, and skillset[139] [140],
- Researcher's gender; this element impact is highly variable, depending on national laws, employment strategies, and cultural biases[141] [142].

International mobility can thus have both positive and negative effects on individual researchers, depending on contextual variables. Through international mobility, researchers have the chance of reconfiguring their own experience and knowledge through the establishment of new personal, geographical, and scientific ties. This allows the researchers to "*continu*[e] *to exploit the cognitive capacities and the scientific vocation under new emotional nuances*"[143]. However, it is crucial to consider the degree of ability to freely choose mobility as a strategy within the overall personal and career development process. In fact, for many researchers, international mobility is perceived more as a "survival strategy", and thus is forced or semi-forced[144] [145] [146]. The resistance to mobility among researchers is in fact higher among those researchers who feel themselves already in a "centre", and thus can more freely decide not to move to reduce its negative effects, while researchers from peripheries and/or from working in contexts that do not offer employment possibilities, deal with complex negotiations between themselves and the needs of other family members in order to move[147].

The more mobility is a forced or semi-forced decision, the more the researcher is likely to be impacted negatively. Negative effects of mobility seem to increase when the "gap of insecurity" caused by mobility is combined with existential insecurity caused by precarity and job instability[148], and when researchers need to negotiate the need for mobility with other family members' needs, especially when they are also caregivers[149]. For these reasons, the economic pressure of international mobility seems to exert a selective pressure against those researchers who

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[130] Cañibano et al. Scientific careers and the mobility of European researchers: an analysis of international mobility by career stage (2020)
[131] Pinheiro et al. Take me where I want to go: Institutional prestige, advisor sponsorship, and academic career placement preferences (2017)
[132] Tovar. Fractured scientific subjectivities. International mobility as an option and obligation (2018)
[133] Cañibano et al. Scientific careers and the mobility of European researchers: an analysis of international mobility by career stage (2020)
[134] Oliver. Living flexibly? How Europe's science researchers manage mobility, fixed-term employment and life outside work (2012)
[135] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[136] Pinheiro et al. Take me where I want to go: Institutional prestige, advisor sponsorship, and academic career placement preferences (2017)
[137] Zabetta and Geuna. International postdoctoral mobility and career effect in Italian academia – 1986-2015 (2019)
[138] Cañibano et al. Scientific careers and the mobility of European researchers: an analysis of international mobility by career stage (2020)
[139] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[140] Oliver. Living flexibly? How Europe's science researchers manage mobility, fixed-term employment and life outside work (2012)
[141] Pinheiro et al. Take me where I want to go: Institutional prestige, advisor sponsorship, and academic career placement preferences (2017)
[142] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[143] Tovar. Fractured scientific subjectivities. International mobility as an option and obligation (2018)
[144] Tovar. Fractured scientific subjectivities. International mobility as an option and obligation (2018)
[145] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[146] Oliver. Living flexibly? How Europe's science researchers manage mobility, fixed-term employment and life outside work (2012)
[147] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[148] Nikunen and Lempiäinen. Gendered strategies of mobility and academic career (2020)
[149] Oliver. Living flexibly? How Europe's science researchers manage mobility, fixed-term employment and life outside work (2012)

find themselves low in the socio-academic hierarchy, and thus it may exert a selective pressure on the overall composition of the academic community.

6.3 Main Points for further Analysis and suggested Input for WP2/3/4

It is vital to stress the importance of "planned" mobility, as a key factor to reduce the adverse effects that the international mobility itself has on the individual researcher, such as work-private life balance, psychological pressure of resettling in a different environment and intercultural adjustments, economic pressure, and weakening of the connection with the "home" team. These adjustments are key factors for supporting the mobility and career development of women (who are more frequently impacted negatively by the need to negotiate between work and private life requirements), of researchers coming from low socio-economic strata, and of researchers from marginalised groups.

Early stable employment (as opposed to precarity) and the concept of the "institutional investment" on the individual researcher are key factors to reduce both the existential anxiety caused by the effects of mobility and precarity and the devaluation of researchers' social and technical worth linked to forced or semi-forced mobility. The last element to be highlighted here is the idea of a win-win-win solution, where the individual researcher, the home institution, and the host institution are ensured to gain some beneficial effects from the international mobility. This aspect is especially relevant when we consider the "geographical prestige differential", that is linked to the brain-drain/brain-gain dynamics. The proposed solution is based more on cooperation than competition and might be beneficial towards a more balanced development of research in different EU areas, that is, to reduce competition within the ERA members and to increase the knowledge circulation within the ERA members.

In conclusion, the activities of WP2/3/4 related to the development of the RCF should:

- Take into consideration the EFRC and European Competence Framework for Researchers (ResearchCOMP) for researchers
- Enhance researchers' skills for the different types of mobility (interinstitutional, intersectoral and international)
- Promote intersectoral mobility between academia and other sectors with specific emphasis on bi-directional mobility
- Strengthen support to and recognition of the different roles of researchers (i.e., R1-R4)
- Consider how TTL models can deal with cross-border social security issues created by international mobility
- Enhance international mobility as an institutional planned strategy and investment on (pre)tenured individual researchers, according to career stage and a development plan
- Improve description and assessment of skills acquired through international mobility, to support career advancement both inside and outside academia
- Consider criteria outside the traditional evaluation system (such as supervision quality, entrepreneurial mindset, and mentoring and career development opportunities and others) while developing a TTL system.

7. Key Conclusions and Input to WP2/WP3/WP4

Deliverable 1.1 presents the main findings of the state-of-the-art on RCFs, with a focus on recruitment and working conditions, career development and progression, and the mobility of researchers. The outcomes of this literature review will directly inform the next steps for the activities planned in WP2 on developing the RCF, WP3 on developing TTL models, and WP4 on testing the RCF and TTL models in pilot research-performing and research-funding organisations in SECURE. These next steps feed directly into the activities in SECURE WP2 (leading to Deliverable 2.1 - First Draft of SECURE Research Career Framework) and WP3 (leading to Deliverable 3.1 - First Draft of Tenure Track-Like Models).

- The SECURE RCF should follow relevant guiding principles of key policy developments in Europe, build on existing frameworks (e.g., EFRC, European Competence Framework for Researchers (ResearchCOMP), RDF from VITAE, and the Researcher Career Framework (RCF) form IUA), and closely align with the work of ERAC on a new EFRC.
- SECURE should develop a RCF that covers all stages of research careers, including recruitment, development and progression, and mobility as well as recognising the different roles of researchers. It should also endorse a fair and transparent researcher assessment system to address adequately the deficits around gender equality and the use of Open Science.
- Work in WP2 should ensure that the RCF provides enough flexibility to facilitate alignment with institutional practices and policies (such as HR management) and country guidelines. The RCF being developed in WP2 should cross-link with the proposal for TTL models being developed in WP3. In this context, SECURE should also consider matters to effectively reduce the precarity of researcher careers through, for example, appropriate funding strategies and distribution.
- The RCF should include options to support recruitment, career development and progression, and mobility, such as mentoring, skills development and training, and career planning. Such interventions could be bundled in holistic programmes aiming at providing researchers with a suite of skills relevant for career advancement both inside and outside academia and be coupled to monitoring.

Based on the literature review, extensive input has been collected to develop a first draft of a RCF that should be based on and linked to the EFRC and provide a comprehensive suite of options for organisations to improve the attractiveness of research careers and reduce precarity. The draft RCF will be further developed based on feedback from the pilot organisations on selected aspects of the RCF and a public consultation with key stakeholders and the wider research community on the RCF.

8. Annexes - Full Bibliography

Annex 1 – Articles Reviewed for Research Career Frameworks

The full bibliography of articles reviewed for Research Career Frameworks is available below.

Authors	Title	Year	DOI or Link
Core literature			
Consult IDEA	Support for continued data collection and analysis concerning mobility patterns and career paths of researchers	2013	https://op.europa.eu/en/publication-detail/-/publication/e9a18042-bdce-11eb-8aca-01aa75ed71a1/language-en#
Council of the EU	Council conclusions on "Deepening the European Research Area: Providing researchers with attractive and sustainable careers and working conditions and making brain circulation a reality".	2021	https://www.consilium.europa.eu/media/49980/st09138-en21.pdf
Council of the EU	Council conclusions on the future governance of the European Research Area (ERA)	2021	https://data.consilium.europa.eu/doc/document/ST-14308-2021-INIT/en/pdf
DANUBIUS-PP	DANUBIUS-RI strategy on Human Resources for Researchers	2016	https://danubius-pp.eu/www/wp-content/uploads/2020/01/9.4.-DANUBIUS-RI-strategy-on-Human-Resources-for-Researchers-final.pdf
Eurodoc and MCAA	Declaration on Sustainable Researcher Careers	2019	https://zenodo.org/record/3082245#:~:text=We%20must%20move%20towards%20better,the%20big%20challenges%20of%20tomorrow."
European Commission	Commission Communication on a European Skills Agenda for Sustainable Competitiveness, Social Fairness, and Resilience	2020	https://ec.europa.eu/social/main.jsp?langId=en&catId=89&newsId=9723#:~:text=Today%20the%20Commission%20presents%20the,within%20the%20next%205%20years.
European Commission	Commission Communication on a European Strategy for Universities	2022	https://education.ec.europa.eu/sites/default/files/2022-01/communication-european-strategy-for-universities-graphic-

			version.pdf
European Commission	Council Recommendation on a Pact for Research and Innovation in Europe	2021	https://data.consilium.europa.eu/doc/document/ST-13701-2021-INIT/en/pdf
European Commission	ESCO European Skills/Competences, Qualifications and Occupations	2020	https://ec.europa.eu/social/main.jsp?catId=1326&langId=en
European Commission	European Charter for Researchers and Code of Conduct for the Recruitment of Researchers	2005	https://euraxess.ec.europa.eu/sites/default/files/am509774cee_en_e4.pdf
European Commission	Evaluation of research careers fully acknowledging Open Science practices	2013	https://op.europa.eu/en/publication-detail/-/publication/47a3a330-c9cb-11e7-8e69-01aa75ed71a1/language-en#
European Commission	Knowledge ecosystems in the new ERA: Talent circulation and intersectoral mobility : analytical report with a mapping of talent mobility and causes of brain drain	2022	https://op.europa.eu/en/publication-detail/-/publication/94a6a2ca-00c1-11ed-b94a-01aa75ed71a1/language-en#
European Commission	MORE4 study: Support data collection and analysis concerning mobility patterns and career paths of researchers	2021	https://op.europa.eu/en/publication-detail/-/publication/e9a18042-bdce-11eb-8aca-01aa75ed71a1/language-en#
European Commission	Research careers in Europe	2016	https://op.europa.eu/en/publication-detail/-/publication/ee53b7d1-9a94-11e6-9bca-01aa75ed71a1/language-en/format-PDF/source-28464705
European Commission	Technical Document on a European Framework for Research Careers. Unpublished document for ERAC Plenary Meeting in February 2023	2023	N/A
European Commission	Towards a European Framework for Research Careers	2011	https://era.gv.at/public/documents/2309/Towards_a_European_Framework_for_Research_Careers_final.pdf
European University Association (EUA)	European Research Area: How to mobilise research-based knowledge for a better and more sustainable future	2020	https://eua.eu/downloads/publications/eua_era_position_final.pdf
ICoRSA	Position Statement on sustainability of research careers and precarity	2022	https://icorsa.org/wp-content/uploads/2022/09/Position-Statement-on-sustainability-of-research-careers-and-precarity_ICoRSA.pdf

Irish University Association (IUA)	Researcher Career Framework	2020	https://www.iua.ie/for-researchers/researcher-career-framework/
LERU	A Pathway towards Multidimensional Academic Careers - A LERU Framework for the Assessment of Researchers	2022	https://www.leru.org/files/Publications/LERU_PositionPaper_Framework-for-the-Assessment-of-Researchers.pdf
LERU	Delivering talent: Careers of researchers inside and outside academia	2018	https://www.leru.org/files/LERU-PP-DeliveringTalent_2018-June.pdf
OECD	Reducing the precarity of academic research careers	2021	https://doi.org/10.1787/0f8bd468-en
Science Europe	Research Culture - Empowering Researchers with a Thriving Research System	2021	https://www.scienceeurope.org/media/vieicpwp/202111-statement-research-culture_v6.pdf
The Guild of European Research-intensive Universities	The EU's emerging Pact for Research and Innovation should meet the expectations of the research sector	2021	https://www.the-guild.eu/publications/statements/the-guild_the-eu's-emerging-pact-for-research-and-innovation-should-meet-the-expectations-of-the-research-sector.pdf
UNESCO	Recommendation on Science and Scientific Researchers. Annex II Recommendation on Science and Scientific Researchers	2017	https://unesdoc.unesco.org/ark:/48223/pf0000260889
Vitae	Concordat to Support the Career Development of Researchers/the Researcher Development Concordat	2019	https://researcherdevelopmentconcordat.ac.uk/wp-content/uploads/2022/01/Researcher-Development-Concordat_Sept2019-1.pdf
Vitae	Researcher Development Framework	2010	https://www.vitae.ac.uk/vitae-publications/rdf-related/researcher-development-framework-rdf-vitae.pdf/view
WIFO Studies	Precarious careers in Research. Analysis and Policy Options	2022	https://www.wifo.ac.at/en/publications/search_for_publications?detail-view=yes&publikation_id=70473
YERUN	Rethinking academic careers	2022	https://yerun.eu/wp-content/uploads/2022/06/YERUN-

			RethinkingAcademicVFinalSpreads.pdf
Additional literature reviewed			
Bray, R. and Boon, S.	Towards a framework for research career development: An evaluation of the UK's Vitae Researcher Development Framework	2013	https://www.researchgate.net/publication/236873689_Towards_a_framework_for_research_career_development_An_evaluation_of_the_UK%27s_Vitae_Researcher_Development_Framework
Kendall, P.	The future of the postdoc	2015	https://www.nature.com/articles/520144a
Lazebnik, Y.	Are scientists a workforce? - Or, how Dr. Frankenstein made biomedical research sick	2015	https://www.embopress.org/doi/full/10.15252/embr.201541266
Nature	The plight of young scientists	2016	https://www.nature.com/articles/538443a
Vogel, G.	Controversial Berlin law gives postdocs pathway to permanent jobs	2021	https://www.science.org/content/article/controversial-berlin-law-gives-postdocs-pathway-permanent-jobs
Vorobieva, O.V. and Teleshova, I.G.	Research activities in the European qualifications system: Experience and problems	2018	10.31857/S02017083220156

Annex 2 – Articles Reviewed for Recruitment and Employment Conditions for Researchers

The full bibliography of articles reviewed for Recruitment and employment conditions for researchers is available below.
Literature marked with an asterisk is considered core literature for the SECURE project by the consortium.

Authors	Title	Year	DOI or Link
Abramo, G., D'Angelo, C.A., Rosati, F.	Gender bias in academic recruitment	2016a	10.1007/s11192-015-1783-3
Abramo, G., D'Angelo, C.A., Rosati, F.	A methodology to measure the effectiveness of academic recruitment and turnover	2016b	10.1016/j.joi.2015.10.004
Abramo, G., D'Angelo, C.A.	Were the Italian policy reforms to contrast favoritism and foster effectiveness in faculty recruitment successful?	2021	10.1093/scipol/scaa048
Allgood S.	Age discrimination and academic labor markets	2020	10.1016/j.jebo.2019.10.024

Bernice J., Teixeira R.	Mentorship: A Successful Tool for Recruitment, Recognition, and Advancement	2002	https://www.scopus.com/inward/record.uri?eid=2-s2.0-0036831381&partnerID=40&md5=bda7181d5217d1ce39217dcb7996751a
Carvalho T., Santiago R.	New challenges for women seeking an academic career: The hiring process in Portuguese higher education institutions	2010	10.1080/13600801003743331
*Council of the European Union	Council conclusions on "Deepening the European Research Area: Providing researchers with attractive and sustainable careers and working conditions and making brain circulation a reality"	2021	https://www.consilium.europa.eu/media/49980/st09138-en21.pdf
Duggan E.M., O'Tuathaigh C.M.P., Horgan M., O'Flynn S.	Enhanced research assessment performance in graduate vs. undergraduate-entry medical students: Implications for recruitment into academic medicine	2014	10.1093/qjmed/hcu064
Enders J.	A chair system in transition: Appointments, promotions, and gate-keeping in German higher education	2001	https://www.scopus.com/inward/record.uri?eid=2-s2.0-23044524689&partnerID=40&md5=faf4cf062a347bf0fb3fa331a939b67c
*European Commission	European Charter for Researchers and Code of Conduct for the Recruitment of Researchers	2005	https://euraxess.ec.europa.eu/sites/default/files/am509774cee_en_e4.pdf
Gaiaschi C., Musumeci R.	Just a matter of time? Women's career advancement in neo-liberal academia. An analysis of recruitment trends in Italian Universities	2020	10.3390/SOCSCI9090163
Herschberg C., Benschop Y., van den Brink M.	Precarious postdocs: A comparative study on recruitment and selection of early-career researchers	2018	10.1016/j.scaman.2018.10.001
Hlengwa A.	How are institutions developing the next generation of university teachers?	2019	10.14426/cristal.v7i1.170
*ICoRSA	Position Statement on sustainability of research careers and precarity	2022	https://icorsa.org/wp-content/uploads/2022/09/Position-Statement-on-sustainability-of-research-careers-and-precarity_ICoRSA.pdf
Lynch C., Sears K.G.	Impact of recruitment, retention and enrichment activities in Preparing Scholars to become Future Faculty	2011	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85029054262&partnerID=40&md5=268c81

			e0c4be0a2b3d7d431f29ca1c01
Riesman D.	Recruitment to the Academic Career	2017	10.4324/9781315125909-9
Roebken H.	Similarity attracts: An analysis of recruitment decisions in academia	2010	10.1177/1741143210368264
Sousa S.B., Magalhães A.M.	A research career? The Portuguese case	2014	10.1080/21568235.2014.915198

Annex 3 – Articles Reviewed for Career Development and Progression for Researchers

The full bibliography of articles reviewed for Career development and progression for researchers is available below.

Authors	Title	Year	DOI or Link
Ahmad S.	Family or Future in the Academy?	2017	10.3102/0034654316631626
Barnes N., du Plessis M., Frantz J.	Career Competencies for Academic Career Progression: Experiences of Academics at a South African University	2022	10.3389/feduc.2022.814842
Baruch Y.	Transforming careers: From linear to multidirectional career paths: Organizational and individual perspectives	2004	10.1108/13620430410518147
Begg M.D., Crumley G., Fair A.M., Martina C.A., McCormack W.T., Merchant C., Patino-Sutton C.M., Umans J.G.	Approaches to preparing young scholars for careers in interdisciplinary team science	2014	10.2310/JIM.0000000000000021
Brüggmann D., Groneberg D.A.	An index to characterize female career promotion in academic medicine	2017	10.1186/s12995-017-0164-7
Byars-Winston A., Gutierrez B., Topp S., Carnes M.	Integrating theory and practice to increase scientific workforce diversity: A framework for career development in graduate research training	2011	10.1187/cbe.10-12-0145
Cañibano C., D'Este P., Otamendi F.J., Woolley R.	Scientific careers and the mobility of European researchers: an analysis of international mobility by career stage	2020	10.1007/s10734-020-00536-z
Chatzea V.-E., Mechili E.A., Melidoniotis E., Petrougaki E., Nikiforidis G., Argyriadis A., Sifaki-Pistolla D.	Recommendations for young researchers on how to better advance their scientific career: A systematic review	2022	10.18332/popmed/152571

Clair R.S., Hutto T., MacBeth C., Newstetter W., McCarty N.A., Melkers J.	The new normal: Adapting doctoral trainee career preparation for broad career paths in science	2017	10.1371/journal.pone.0177035
Claydon J., Farley-Barnes K., Baserga S.	Building skill-sets, confidence, and interest for diverse scientific careers in the biological and biomedical sciences	2021	10.1096/fba.2021-00087
Crossouard B.M.	The (re-)positioning of the doctorate through the eyes of newly qualified researchers	2010	10.1080/17450144.2010.498524
Denton M., Borrego M., Chang C.-N., Boklage A., Arroyave R.	Non-academic career pathways for engineering doctoral students: An evaluation of an NSF research traineeship program	2020	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85095796337&partnerID=40&md5=4800f83460b7f17832d1d22b2d101a12
Farnese M.L., Spagnoli P., Livi S.	Undergraduates' academic socialization. A cross-time analysis	2022	10.1111/bjep.12497
Grinstein A., Treister R.	The unhappy postdoc: A survey based study	2018	10.12688/f1000research.12538.2
House A., Dracup N., Burkinshaw P., Ward V., Bryant L.D.	Mentoring as an intervention to promote gender equality in academic medicine: A systematic review	2021	10.1136/bmjopen-2020-040355
Ivancheva L., Gourova E.	Challenges for career and mobility of researchers in Europe	2011	10.3152/030234211X12834251302445
Kochen M.M., Himmel W.	Academic careers in general practice: Scientific requirements in Europe	2000	10.3109/13814780009094306
Lenzi R.N., Korn S.J., Wallace M., Desmond N.L., Labosky P.A.	The NIH "BEST" programs: Institutional programs, the program evaluation, and early data	2020	10.1096/fj.201902064
Marini G.	Coercive and mimetic isomorphism as outcomes of authority reconfigurations in French and Spanish academic career systems	2021	10.1080/23322969.2020.1806726
Miller C.L., Jr., Worsham R.E., Ghosal L.N.	Full paper the career identity program: Creating a personalized academic-to-career plan for first-year engineering students	2018	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85096642250&partnerID=40&md5=628670bfe217c6dcbacc475b5a95a624
Montes López E., O'Connor P.	Micropolitics and meritocracy: Improbable bed fellows?	2019	10.1177/1741143218759090
Moore C.L., Washington A.L., Manyibe E.O.	Peer Multiple Mentor Model (P3M) for Training Disability/Health and Rehabilitation Equity Researchers: Case Study at a Historically Black College/University	2022	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85135036064&partnerID=40&md5=75365b

			4fbd02019b2fcdb097890f787e
Müller R., Kaltenbrunner W.	Re-disciplining Academic Careers? Interdisciplinary Practice and Career Development in a Swedish Environmental Sciences Research Center	2019	10.1007/s11024-019-09373-6
Panettieri R.A., Jr., Kolls J.K., Lazarus S., Corder S., Harshman A., Langmack E., Petrache I.	Impact of a Respiratory Disease Young Investigators' Forum on the Career Development of Physician-Scientists	2020	10.34197/ats-scholar.2019-0018OC
Pieters D., Schoukens P.	Improving the social security of internationally mobile researchers	2011	10.1016/j.sbspro.2011.03.004
Rybarczyk B., Lerea L., Lund P.K., Whittington D., Dykstra L.	Postdoctoral training aligned with the academic professoriate	2011	10.1525/bio.2011.61.9.8
Sanz-Menéndez L., Cruz-Castro L.	University academics' preferences for hiring and promotion systems	2019	10.1080/21568235.2018.1515029
Seeber M., Debacker N., Meoli M., Vandevelde K.	Exploring the effects of mobility and foreign nationality on internal career progression in universities	2022	10.1007/s10734-022-00878-w
Smit E., van den Berg H.	Assisted self-mentorship of a boundaryless research career	2016	10.1080/23311983.2016.1185239
Sood A., Tigges B., Helitzer D.	Mentoring Early-Career Faculty Researchers Is Important - But First "train the Trainer"	2016	10.1097/ACM.0000000000001264
Sorkness C.A., Pfund C., Ofili E.O., Okuyemi K.S., Vishwanatha J.K., Zavala M.E., Pesavento T., Fernandez M., Tissera A., et al.	A new approach to mentoring for research careers: The National Research Mentoring Network	2017	10.1186/s12919-017-0083-8

Annex 4 – Articles Reviewed for Interinstitutional, Intersectoral, and International Mobility

The full bibliography of articles reviewed for Interinstitutional, intersectoral, and international mobility is available below.
Literature marked with an asterisk is considered core literature for the SECURE project by the consortium.

Authors	Title	Year	DOI or Link
Cañibano C., D'Este P., Otamendi F.J., Woolley R.	Scientific careers and the mobility of European researchers: an analysis of international mobility by career stage	2020	10.1007/s10734-020-00536-z
Cattaneo M., Horta H., Meoli M.	Dual appointments and research collaborations outside academia: evidence from the European academic population	2019	10.1080/03075079.2018.1492534

Cruz-Castro L., Sanz-Menéndez L.	The employment of PhDs in firms: Trajectories, mobility and innovation	2005	10.3152/147154405781776292
*European Commission	MORE4 study: Support data collection and analysis concerning mobility patterns and career paths of researchers - Survey on researchers in European Higher Education Institutions	2020	10.2777/132356
*European Commission	Knowledge ecosystems in the new ERA: Talent circulation and intersectoral mobility	2022	10.2777/620810
Fernández-Zubieta A., Geuna A., Lawson C.	What do we know of the mobility of research scientists and impact on scientific production	2015	10.1016/B978-0-12-801396-0.00001-6
Gourova E., Sanopoulos D.	Knowledge transfer and mobility: EURAXESS role in europe	2010	https://www.academia.edu/download/45531333/Knowledge_transfer_and_mobility_EURAXESS20160511-22946-myovz.pdf
Guzmán Tovar C.	Fractured scientific subjectivities. International mobility as an option and obligation	2018	10.1080/25729861.2018.1536309
Hottenrott H., Lawson C.	Flying the nest: how the home department shapes researchers' career paths	2017	10.1080/03075079.2015.1076782
Janger J., Campbell D.F.J., Strauss A.	Attractiveness of jobs in academia: a cross-country perspective	2019	10.1007/s10734-019-00383-7
Kastberg S.M.	"sensitive Fences": The im/mobility of working-class academics	2014	10.1108/S1479-362820140000011018
Netz N., Hampel S., Aman V.	What effects does international mobility have on scientists' careers? A systematic review	2020	10.1093/reseval/rvaa007
Nikunen M., Lempiäinen K.	Gendered strategies of mobility and academic career	2020	10.1080/09540253.2018.1533917
Oliver E.A.	Living flexibly? How Europe's science researchers manage mobility, fixed-term employment and life outside work	2012	10.1080/09585192.2012.657004
Pieters D., Schoukens P.	Improving the social security of internationally mobile researchers	2011	10.1016/j.sbspro.2011.03.004
Pinheiro D.L., Melkers J., Newton S.	Take me where I want to go: Institutional prestige, advisor sponsorship, and academic career placement preferences	2017	10.1371/journal.pone.0176977
Probst C., Goastellec G.	Internationalisation and the academic labour market	2013	10.1007/978-94-007-4614-5_7
Schaer M.	Early-Career Academics' Transnational Moves: The Gendered Role of Vertical Social Ties in Obtaining Academic Positions Abroad	2022	10.1007/978-3-030-94972-3_10

Teichler U.	Academic mobility and migration: What we know and what we do not know	2015	10.1017/S1062798714000787
Toma S., Villares-Varela M., Czaika M.	Internationalization and diversification of academic careers	2018	10.1093/oso/9780198815273.003.0012
Zabetta M.C., Geuna A.	International postdoctoral mobility and career effect in Italian academia – 1986-2015	2019	http://hdl.handle.net/2318/1797874

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