DeepTechSeeds

Fostering Talent Ecosystems for Early-Stage Researchers in Deep Tech

Deliverable D2.1
Analysis Report on Charter Implementation

Funded by the European Union

Supporting the European Research Area

The *DeepTechSeeds* project has received funding from the European Union's Horizon Europe research and innovation programme, under the Reforming and Enhancing the European R&I System strand (HORIZON-WIDERA-2024-ERA-02-03), *Grant Agreement No. 101216535*.

Date of delivery:	28/02/2026	Version:	1.0
Project reference:	101216535	Call:	HORIZON-WIDERA-2024-ERA-02-03
Start date of project:	01/10/2025	Duration:	36 months

Document properties:

Deliverable Number:	D2.1
Deliverable Title:	Analysis Report on Charter Implementation
Project	DeepTechSeeds
Coordinator	National Center for Scientific Research DEMOKRITOS (NCSRD)
Authors:	Jana Simanova (TUL), Lenka Koskova Triskova (TUL), Blanka Brandova (TUL), Stefanos Plastras (NCSRD), Harilaos Koumaras (NCSRD), Marco Meireles (EURA)
Reviewers:	Harilaos Koumaras (NCSRD), Stefanos Plastras (NCSRD), Marco Meireles (EURA)
Dissemination level:	SEN[1]
Status:	Submitted
File Name:	DEEPTECHSEEDS_D2.1_v1.0.pdf

Document History

Version	Date	Issued by	Description
0.1	11.11.2025	Stefanos Plastras (NCSRD)	Initial draft structure and project framework setup.
0.2	23.11.2025	Jana Simanova (TUL)	First analytical draft including preliminary methodology and structure.
0.3	15.12.2025	Marco Meireles (EURA)	Consolidated draft integrating consortium input and policy context.
0.4	15.01.2026	Jana Simanova (TUL)	Expanded analytical content and integration of empirical findings
0.5	20.02.2026	Jana Simanova (TUL)	Pre-final analytical version including triangulation and structural gap analysis
1.0	27.02.2026	Harilaos Koumaras (NCSRD)	Final submitted version incorporating consortium validation.

Disclaimer

Funded by the European Union. The views and opinions expressed are however those of the author(s) only and do not necessarily reflect the views of DeepTechSeeds Consortium nor those of the European Union or Horizon WIDERA. Neither the European Union nor the granting authority can be held responsible for them.

Keywords

European Charter for Researchers; Deep-tech research ecosystems; Early-Career Researchers (ECRs); Charter operationalisation; Context–Mechanism–Outcome (CMO) analysis; Realist evaluation; Triangulated mixed-methods research; Research governance and ERA policy alignment; Intersectoral mobility pathways; Innovation-oriented evaluation frameworks; Hybrid knowledge governance; Talent ecosystem development.

[1] SEN = Sensitive, only members of the consortium (including the Commission Services). Limited under the conditions of the Grant Agreement

PU = Public

Executive Summary

Deliverable D2.1 provides the **analytical foundation for strengthening the operationalisation of the European Charter for Researchers (2023)** within deep-tech research environments. While **formal endorsement of Charter principles is widespread**, this report examines how those principles function under **structurally demanding deep-tech conditions**, including infrastructure intensity, project-based funding dependency, hybrid academia–industry knowledge governance and increasingly non-linear career trajectories.

The objective of the analysis is **not to assess formal compliance**, but to identify **structural conditions shaping implementation effectiveness** and to provide an **evidence-based foundation for the DeepTech Framework (Task 2.2)**.

The report is grounded in a **triangulated mixed-methods design**, integrating survey data from **354 respondents** (218 Early-Career Researchers, 78 Research-Performing Organisations and 58 industry representatives), stakeholder-specific focus groups, structured interviews and comparative national mapping. The application of a **Context–Mechanism–Outcome analytical framework** enables interpretation at ecosystem level and strengthens the robustness of findings.

Across stakeholder groups, recruitment procedures are perceived as **transparent and merit-based (mean 4.21/5)**, indicating strong procedural alignment with Charter principles. However, **career pathway clarity is significantly weaker (mean 3.36/5)**, and **48.6 % of Early-Career Researchers identify unclear progression trajectories as a primary barrier**. With **72.5 % of ECRs employed in project-dependent doctoral contracts**, career predictability is structurally conditioned by funding architecture rather than deficiencies in recruitment governance. Institutions confirm this constraint, with **33.3 % citing insufficient funding** and **25.6 % limited staff capacity** as key implementation barriers.

A second systemic pattern concerns evaluation practices. Despite **high academia–industry collaboration (84.7 % of Research Performing Organization-RPOs report regular cooperation; 62.1 % of companies describe collaboration as strategic)**, evaluation systems remain predominantly publication-centred. Industry stakeholders do not question scientific excellence; rather, they highlight deficits in **intellectual property and regulatory awareness (mean lacking 3.32/5)** and **business understanding (3.28/5)**. Applied outputs—patents, prototypes and translational activities—are strategically valued but **unevenly integrated into academic promotion criteria**, revealing a partial misalignment between innovation policy objectives and institutional evaluation systems.

Hybrid knowledge governance constitutes a third structural tension. While training exposure in **research integrity (45.9 %) and open science (39.4 %)** is relatively widespread, only **22.9 % of ECRs report training in intellectual property and patent regulation**, and confidence in IP-related matters is lowest among governance domains (**mean 2.51/5**). Deep-tech ecosystems require balancing openness and protection, yet structured mediation between publication incentives and protection-before-dissemination sequencing remains underdeveloped.

Intersectoral mobility presents a similar paradox. **79.8 % of ECRs express openness to industry placements**, yet systemic pathways remain fragile. Reported barriers include **cultural differences (47.7 %)**, **unclear transition routes (37.6 %)**, **administrative barriers (59.0 % reported by institutions)** and **IP/legal constraints (43.6 %)**. Industry actors emphasise the need for **financial support (79.3 %) and procedural simplification** to host researchers. Collaboration intensity is therefore high, but **reintegration and recognition mechanisms are weakly institutionalised**.

The gender dimension reflects **structural underrepresentation (77.1 % male; 22.9 % female)** rather than procedural inequity. While **84.6 % of institutions implement Gender Equality Plans** and recruitment fairness is perceived similarly across genders, participation asymmetries highlight the need for retention-sensitive approaches in infrastructure-intensive domains.

Across macro-regions and institutional types, the evidence demonstrates **strong normative alignment with Charter values**. Implementation gaps arise primarily from **ecosystem architecture**: funding volatility, evaluation inertia, hybrid knowledge governance complexity, mobility sequencing challenges and structural inclusion asymmetries.

The central conclusion is therefore clear: **effective Charter implementation in deep-tech contexts requires structural alignment rather than additional normative articulation**. The forthcoming DeepTech Framework must prioritise:

- **Funding-resilient career architectures**,
- **Evaluation recalibration recognising translational outputs**,
- **Structured integration of IP literacy**,
- **Institutionalised intersectoral mobility pathways**,
- **Domain-sensitive inclusion and retention strategies**.

Deliverable D2.1 thus establishes a **robust, triangulated evidence base** and provides the analytical bridge from **policy commitment to operational architecture** in strategically critical deep-tech sectors.

Beyond reporting findings, D2.1 also makes available the structured triangulated research instruments developed under Task 2.1. By sharing survey templates and focus group scenarios, the project supports replicability and scaling of Charter implementation monitoring across European deep-tech ecosystems.

Table of Contents

List of Tables

List of Figures

ACRONYMS AND ABBREVIATIONS

Term	Description
AI/ML	Artificial Intelligence / Machine Learning
CMO	Context–Mechanism–Outcome
DeepTechSeeds	Fostering Talent Ecosystems for Early-Stage Researchers in Deep Tech
ECR	Early-Career Researcher
ERA	European Research Area
GDPR	General Data Protection Regulation
HRS4R	Human Resources Strategy for Researchers
IP	Intellectual Property
RPO	Research-Performing Organisations
ResearchComp	European Competence Framework for Researchers
R&I	Research and Innovation
WIDERA	Reforming and Enhancing the European Research and Innovation System

1 INTRODUCTION

DeepTechSeeds is a European talent-ecosystem project that strengthens early-career research careers in deep tech by combining needs analysis, mentoring models, and tailored training with structured academia–industry collaboration and support for commercialization pathways across the ERA. In this context, DeepTechSeeds addresses the critical need for a highly skilled and adaptable research workforce in Europe's deep tech sectors. As global competition intensifies in fields such as artificial intelligence, quantum computing, robotics, and advanced materials, the project aims to create a dynamic and interconnected talent ecosystem that seamlessly bridges academia, industry, and the public sector.

The project's core objective is to reshape the landscape of early research careers in deep tech fields by implementing a comprehensive framework based on the new Charter for Researchers. This framework will guide participating organizations through a process of structural change, creating more attractive and sustainable career pathways for Early-Career Researchers (ECRs).

This deliverable presents an analytical needs assessment examining how structural characteristics of deep-tech ecosystems shape the operationalisation of the European Charter for Researchers within the DeepTechSeeds project (Task 2.1). Rather than assessing formal compliance, the report identifies systemic mechanisms influencing implementation outcomes and establishes the analytical basis for subsequent framework development.

The analysis adopts a triangulated mixed-methods design combining survey data, stakeholder focus groups, structured interviews and comparative policy mapping. A Context–Mechanism–Outcome (CMO) analytical framework is applied to identify recurring structural patterns affecting Early-Career Researchers, research-performing organisations and industry stakeholders.

The objective is to identify ecosystem-level implementation conditions and structurally mediated gaps that require alignment at funding, evaluation, knowledge governance and mobility levels. The report therefore focuses on systemic mechanisms and operational dynamics rather than normative evaluation.

The document is structured as follows: Chapter 2 establishes the policy and structural context; Chapter 3 outlines the methodological and analytical framework; Chapter 4 presents stakeholder-level empirical findings; Chapter 5 provides cross-stakeholder triangulation through CMO analysis; Chapters 6 and Chapter 7 map Charter implementation and consolidate structural gaps; Chapter 8 translates findings into framework design principles; and Chapter 9 concludes.

2 POLICY AND STRUCTURAL CONTEXT

The implementation of the European Charter for Researchers is conditioned by multi-level governance architectures, national research system configurations and domain-specific structural dynamics. It does not unfold in an institutional vacuum, nor can it be assessed solely through formal policy alignment.

The contextual analysis presented in this chapter is based on a structured desk review of EU-level policy documents, ERA monitoring reports, national research and innovation strategies and publicly available HRS4R institutional documentation. The objective is not to assess compliance, but to identify governance configurations and structural conditioning factors that shape Charter operationalisation in deep-tech environments.

This chapter establishes the analytical baseline for the needs analysis conducted under Task 2.1. It first situates the Charter within the broader governance architecture of the European Research Area (ERA). It then outlines differentiated national implementation configurations across consortium countries. Finally, it identifies structural characteristics of deep-tech research environments that condition how Charter principles are operationalised in practice.

By distinguishing between governance-mediated implementation depth and domain-specific structural conditioning, this chapter provides the contextual layer necessary for interpreting the empirical Context–Mechanism–Outcome (CMO) analysis presented in Chapter 5.

2.1 European Charter and ERA Governance Context

The European Charter for Researchers (2023) constitutes a central governance instrument of the European Research Area. It establishes principles concerning research integrity, recruitment transparency, working conditions, career development, evaluation systems, intersectoral mobility and inclusive research environments. The Charter operates in synergy with the HR Excellence in Research Award (HRS4R), the Pact for Research and Innovation in Europe and the European Competence Framework for Researchers (ResearchComp). [1]

The Human Resources Strategy for Researchers (HRS4R) functions as the primary operational mechanism for institutional Charter implementation. Through structured gap analyses, action plans and periodic self-assessment cycles, HRS4R translates normative principles into organisational processes. However, the existence of formal action plans does not automatically ensure systemic coherence, as implementation depth remains mediated by funding architecture, evaluation regimes and institutional capacity.

Across Europe, research-performing organisations broadly endorse Charter principles and frequently integrate them into formal HR policies and procedures. However, normative alignment does not automatically translate into operational depth. The gap between formal endorsement and implementation coherence constitutes a recurrent theme across national contexts. [2]

Institutional HRS4R documentation across consortium countries indicates high levels of formal engagement with Charter principles, while simultaneously revealing variability in implementation depth, particularly in areas related to employment stability, evaluation reform and intersectoral mobility governance.

Operationalisation is mediated by:

- Funding architecture
- Evaluation regimes
- Institutional HR capacity
- Governance coordination models

Task 2.1 therefore moves beyond assessing formal compliance and instead examines how Charter principles function under structurally specific deep-tech conditions. The focus is not normative commitment, but the interaction between governance intent and systemic constraints. [12], [13], [14]

2.2 National Implementation Patterns (Comparative Overview)

A comparative review of consortium countries (Greece, Spain, Malta, France, Portugal and Czechia) reveals differentiated governance configurations shaping Charter implementation. These configurations differ in governance centralisation, reform velocity and institutional buffering capacity [3] [2].

The typology presented below emerges from structured comparison of institutional HRS4R gap analyses, action plans and national research governance frameworks across consortium countries. Rather than classifying countries according to formal compliance status, the analysis focused on governance centralisation, reform sequencing and systemic buffering capacity. The resulting configurations reflect structural patterns observed across documentation, rather than normative ranking or performance evaluation.

Across consortium countries, three governance configurations can be identified:

- Strongly institutionalised / coordinated systems
- Hybrid or transitional systems
- Institution-driven systems with strong EU leverage

These configurations condition implementation depth and interact with the structural mechanisms identified later in the analysis.

2.2.1 Coordinated Governance Systems (Spain, France)

These systems exhibit centralised research coordination, high penetration of HRS4R processes and structured HR governance frameworks. Charter principles are formally embedded within institutional practices and nationally coordinated research organisations.

However, despite strong formal integration, evaluation cultures remain predominantly publication-centred, including within applied research domains. Translational and industry-relevant outputs are not consistently embedded in progression criteria.

2.2.2 Hybrid or Reforming Systems (Portugal, Czechia)

These countries demonstrate strong alignment with European research policy frameworks and dynamic innovation agendas. Governance reforms are ongoing, and Charter integration is expanding through institutional HR strengthening.

Nevertheless, competitive project-based funding plays a central role in shaping employment stability and evaluation incentives. Contract volatility and uneven evaluation reform remain structural constraints.

2.2.3 Institution-Driven Systems with Strong EU Leverage (Greece, Malta)

In these contexts, Charter adoption is frequently initiated at institutional level and reinforced through participation in EU programmes. National coordination mechanisms are evolving, and implementation depth depends significantly on organisational capacity and resource availability.

Despite governance differences, three structural continuities persist across configurations:

1. Formal endorsement of Charter principles.
2. Persistence of publication-oriented evaluation traditions.
3. High reliance on project-based employment at early-career stages.

National variation modifies intensity, but not the underlying structural logic. Many implementation tensions are therefore systemic and governance-mediated rather than country-specific. Differences are less visible at the level of normative adoption and more pronounced in structural parameters such as employment predictability, evaluation recalibration depth and mobility reintegration mechanisms.

The comparative mapping below (see Table 1) summarises governance configuration, implementation maturity and deep-tech-relevant structural gaps across consortium countries. This governance landscape provides the contextual baseline against which deep-tech implementation dynamics must be interpreted. It further suggests that governance configuration influences the degree of institutional buffering against project-based volatility, yet does not eliminate structural tensions inherent to deep-tech research environments. Detailed pillar-specific national nuances are presented in Annex V.

Table 1: Comparative Governance Configurations and Implementation Gaps Across Consortium Countries

Country	Governance Configuration	Implementation Maturity	HRS4R / HR Excellence (Qualitative Status)	National-Level Measures Relevant to Researcher Careers	Deep-Tech-Relevant Implementation Gaps
Spain	Strongly institutionalised / coordinated system	High formal integration within coordinated national research governance	High penetration; Charter compliance embedded in institutional HR strategies	Explicit linkage between research career policy and Charter priorities; emphasis on transparent recruitment and contractual stability	Persistent bibliometric dominance in evaluation frameworks; applied outputs not systematically embedded in progression criteria
France	Strongly institutionalised / coordinated system	High formal integration within structured organisational landscape	High penetration in coordinated environments; institutional uptake may vary	Charter reinforced through nationally coordinated research organisations and structured HR approaches	Early-career stages remain grant-dependent; recognition of translational outputs uneven
Portugal	Hybrid / transitional system	Strong formal alignment within rapidly evolving innovation ecosystem	Increasing uptake through institutional alignment; evolving governance frameworks	Innovation agenda supported by national strategic programmes; growing integration of innovation discourse	Contract volatility persists; evaluation reform structurally constrained despite innovation intensity
Czechia	Hybrid / transitional system	Increasing alignment with variability across institutions	Growing uptake through strengthened institutional HR governance	Progressive alignment with European standards; institutional reform in motion	Persistent project-based employment models; uneven recalibration of evaluation criteria
Greece	Institution-driven implementation with strong EU leverage	Bottom-up trajectory; increasing institutional initiative	Institutional applications rising; national-level coordination still developing	Institutional initiatives benchmarked against EU standards; strong reliance on EU-funded research	Implementation depth varies across organisations; systemic alignment evolving
Malta	Institution-driven implementation with strong EU leverage	Early-stage formalisation; strong scale effects	Early-stage uptake; implementation depth institution-dependent	Growing commitment to transparent recruitment and researcher development	Structural vulnerability due to system scale; early-career pathways sensitive to funding volatility

2.3 Deep-Tech Structural Specificieties

Deep-tech domains—including artificial intelligence, robotics, telecommunications (5G/6G), advanced materials and quantum technologies—occupy a strategic position within European innovation policy. They are central to technological sovereignty and industrial competitiveness [4] [11].

Beyond strategic importance, these domains exhibit structural characteristics that directly condition Charter operationalisation:

2.3.1 Infrastructure Intensity

Deep-tech research depends on specialised laboratories, high-cost equipment and long-term technological platforms. Institutional continuity is closely linked to external funding cycles and capital investment rhythms.

2.3.2 Project-Based Funding Dependency

Competitive grants and industry co-financing constitute primary funding mechanisms. Employment contracts—particularly for early-career researchers—are frequently tied to project duration, reinforcing contractual temporality and limiting long-term predictability.

2.3.3 Hybrid Knowledge Governance

Deep-tech research operates at the intersection of academic openness and industrial intellectual property regimes. Open science expectations coexist with protection-before-publication requirements, creating dual governance logics and sequencing tensions.

2.3.4 Strong Academia–Industry Coupling

Intersectoral collaboration is structurally embedded through joint R&D projects, co-supervised doctorates and technology transfer partnerships. However, evaluation criteria, time horizons and performance logics differ across sectors [6] [15] [9].

2.3.5 Hybrid and Non-Linear Career Trajectories

Career pathways increasingly involve movement between academia, industry, start-ups and public research organisations. Traditional linear academic progression models insufficiently capture this dynamic. [16]

2.3.6 Persistent Gender Imbalance

Deep-tech domains remain male-dominated across Europe, influencing representation patterns, leadership pipelines and inclusion dynamics [5].

These structural characteristics do not challenge the normative validity of Charter principles. Rather, they condition the mechanisms through which those principles generate outcomes. Governance configuration and deep-tech structural dynamics jointly form the contextual layer within which implementation mechanisms operate.

The empirical analysis in subsequent chapters therefore interprets observed tensions not as deviations from policy intent, but as context-sensitive manifestations of structurally conditioned implementation dynamics.

3 METHODOLOGY AND ANALYTICAL FRAMEWORK

This chapter outlines the research design, data sources and analytical logic underpinning Task 2.1. The methodological objective was to generate robust, triangulated evidence on how the European Charter for Researchers is operationalised in deep-tech research ecosystems and to identify structurally mediated implementation gaps affecting Early-Career Researchers (ECRs).

Given the complexity of deep-tech environments characterised by project-based funding, strong academia–industry coupling, infrastructure dependency and hybrid career trajectories, a single-method approach would have been insufficient. The study therefore adopted a structured mixed-methods design integrating quantitative, qualitative and comparative policy evidence.

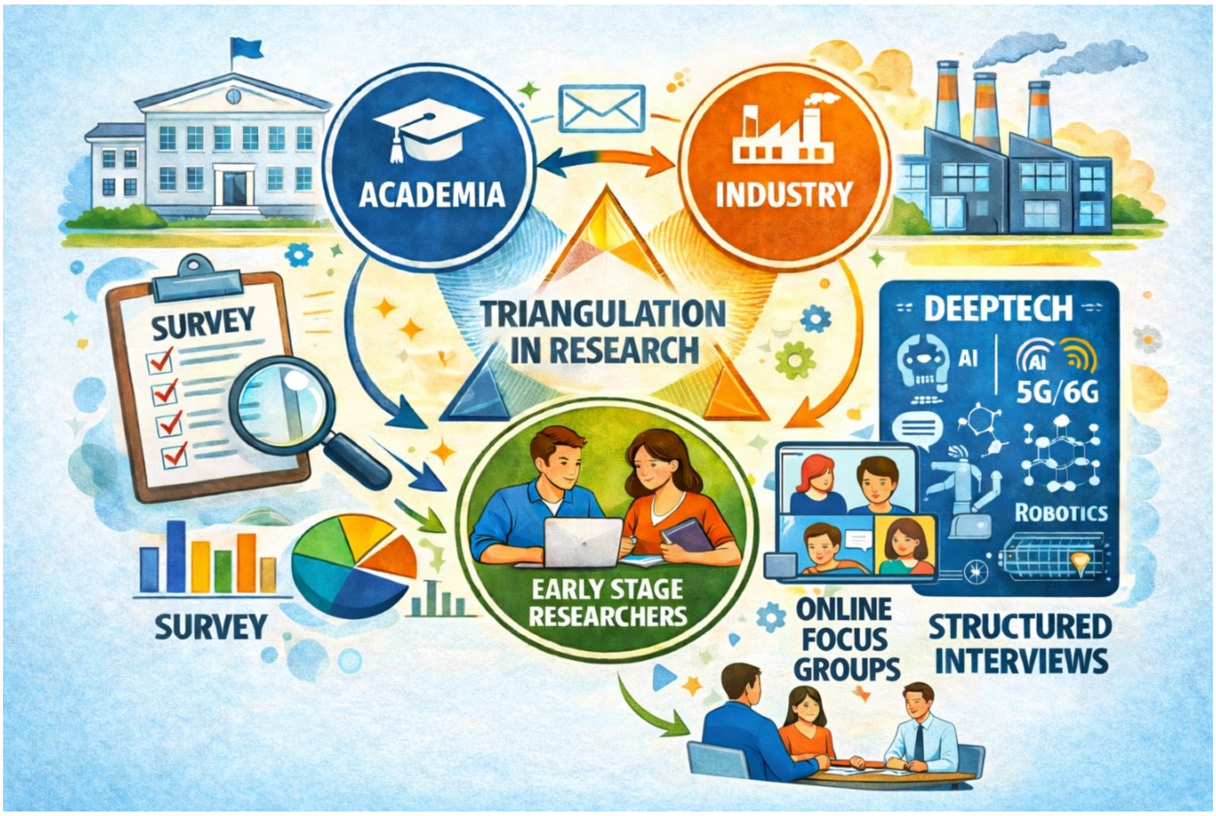

Figure 1: Triangulation in Research

3.1 Research Design and Stakeholder Sample

Task 2.1 was implemented as a practice-oriented needs analysis combining four complementary evidence streams:

1. Multi-stakeholder survey data
2. Stakeholder-homogeneous focus groups and structured interviews
3. Comparative national policy review across consortium countries
4. EU-level governance analysis of the European Charter for Researchers (2023)

This design ensures both breadth (through structured survey coverage) and contextual depth (through qualitative inquiry), while enabling systematic cross-validation of findings.

The triangulated stakeholder sample comprises:

- Early-Career Researchers (ECRs) active in deep-tech domains
- Research-Performing Organisations (RPOs), including universities and research centres
- Industry representatives operating in deep-tech sectors

The survey component collected **354 responses** across three stakeholder strands:

- ECRs: **n = 218**
- Academic Institutions (RPOs): **n = 78**
- Industry Representatives: **n = 58**

These maps illustrate the geographical distribution of responses to the DeepTechSeeds questionnaires, demonstrating broad European coverage across key stakeholder groups. The industry survey attracted participation mainly from the Czech Republic, Greece, Portugal, and Spain, reflecting private-sector interest in deep-tech talent development. The ECR survey showed strong engagement from Eastern and Southern Europe, including the Czech Republic, Greece, Poland, Spain, and Portugal, among early-career researchers. Similarly, the academia/RTO survey garnered responses from numerous institutions across at least five countries, such as the Czech Republic, Greece, Portugal, and Spain, underscoring institutional commitment to enhancing researcher careers in deep tech. Figure 2 shows the countries contribution to this deliverable work.

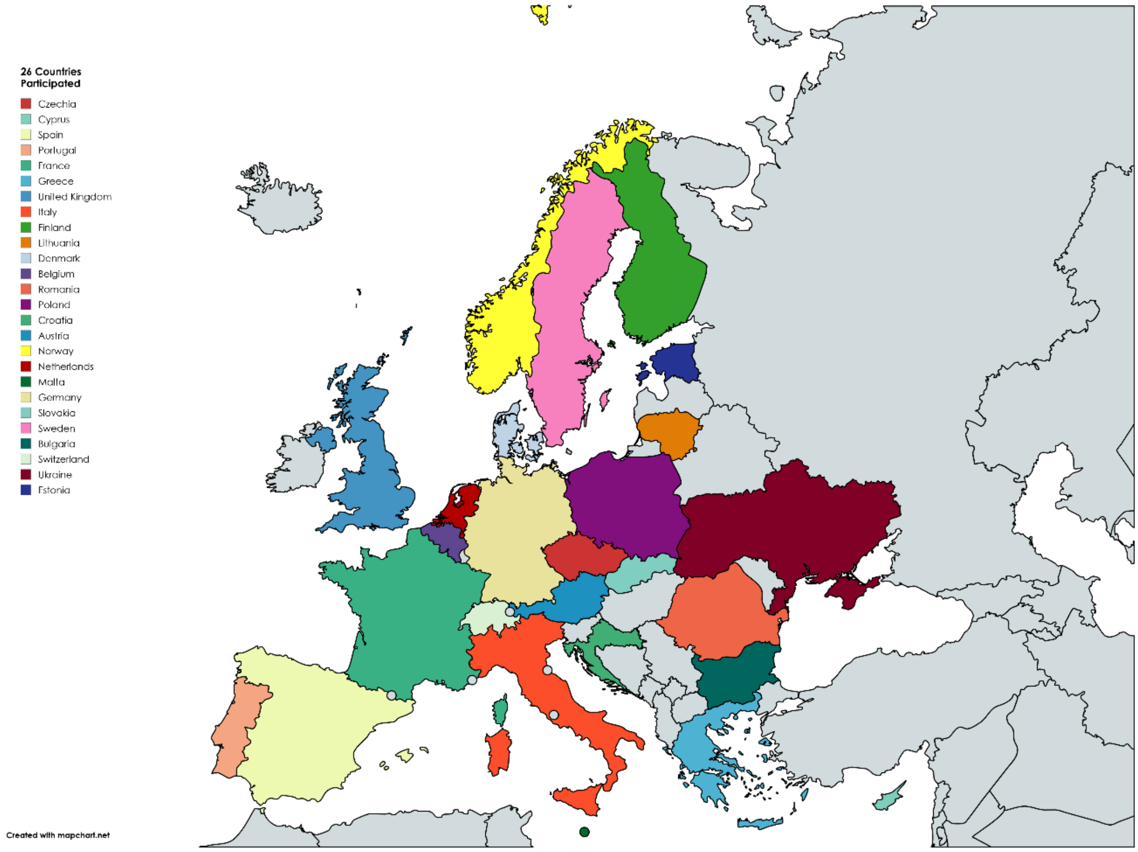

Figure 2: Academia/RTOs countries participation

The ECR sample is dominated by AI/ML (60.6 %) and Advanced Materials (20.2 %), with 72.5 % of respondents being PhD candidates. The gender distribution (77.1 % male; 22.9 % female) reflects the demographic structure typical of engineering-intensive deep-tech fields.

The RPO sample (n = 78) includes universities (66.7 %), public research centres (25.6 %) and private research organisations (7.7 %) across 16 European countries. Approximately 35.9 %

report primary engagement in deep-tech domains and 48.7 % partial engagement. Notably, 38.5 % of institutions hold the HR Excellence in Research Award and an additional 20.5 % are in progress, indicating substantial formal alignment with Charter-related governance processes.

The industry sample (n = 58) comprises a mix of large enterprises (34.5 %), SMEs (31.0 %), small companies (24.1 %) and micro-enterprises/startups (10.3 %). A majority (58.6 %) identify as primarily deep-tech companies, with strong representation in AI/ML (75.7 %), telecommunications (44.8 %), robotics (31.0 %) and advanced materials (31.0 %). The sample therefore reflects firms with active R&D engagement and direct exposure to talent and collaboration dynamics.

Survey items capturing demographic and domain background are detailed in **Annex I** – Survey Instruments.

In addition to the survey, **24 participants** contributed qualitative insights through four stakeholder-homogeneous focus groups and **15 structured interviews**.

To enable comparative interpretation without overemphasising single-country effects, countries were grouped into macro-regions reflecting geographical proximity and relative Charter implementation maturity (Central & Eastern Europe; Southern Europe; Western Europe; Northern Europe). The regional distribution of survey respondents is presented in Table 3.

Table 2: Overview of Stakeholder Survey Sample Distribution

Geographical Area	Countries Included (*≥20 responses)	ECRs	Companies*	Academia
Central & Eastern Europe	**Czech Republic*, Slovakia***, Austria, Bulgaria, Estonia, Lithuania, Croatia, Poland, Romania, Latvia, Slovenia, Hungary	124	50*	30
Southern Europe	**Greece*, Spain*,** Portugal, Italy, Cyprus, Malta	92	54*	36
Western Europe & Northern Europe	**Germany***, Switzerland, France. Belgium, Finland, Netherlands, United Kingdom, Norway, Denmark, Ireland, Sweden, Luxembourg	2	60*	12

Note: Countries were grouped into policy-relevant macro-regions to support interpretation across differentiated research system environments.

**Companies were assigned to macro-regions based on the location of their operational headquarters; where firms reported multi-country activity, responses are interpreted as reflecting transnational industry dynamics rather than a single national operating environment.*

While the dataset is not exhaustive of the European deep-tech landscape, it provides enough diversity across sectors and regions to highlight consistent systemic trends. Analytical robustness is strengthened through consistency of findings across stakeholder groups and triangulation with qualitative evidence.

3.2 Survey Instruments and Analytical Dimensions

Three tailored survey instruments were developed to capture differentiated perspectives while maintaining thematic comparability:

- Early-Career Researchers (ECRs)
- Research-Performing Organisations (RPOs)
- Industry representatives

The full survey instruments for all stakeholder groups are provided in **Annex I** – Survey Instruments (Annex I.A–I.C).

Across instruments, items were aligned to Charter-relevant domains including:

- Working conditions and employment stability
- Evaluation and career progression
- Mentoring and supervision
- Intersectoral mobility
- Skills development (with competence signals used as supportive evidence)
- Gender and inclusion dynamics

The structure of the questionnaires reflects direct alignment with Charter domains and is documented in **Annex I** – Survey Instruments.

The ECR survey additionally captured deep-tech domain background, prior industry experience and career aspirations. The RPO survey examined HR governance structures, HRS4R alignment, institutional size and deep-tech engagement intensity. The industry survey focused on competence expectations, collaboration intensity, mobility feasibility and innovation governance practices.

Where analytically meaningful and sufficiently powered, subgroup patterns were explored (gender, selected national clusters, domain groups, institutional size, HR Award status, and company size). Subgroup outputs are reported selectively where they sharpen interpretation and are not over-interpreted.

3.3 Focus Groups and Qualitative Inquiry

To complement quantitative patterns and explain underlying mechanisms, four stakeholder-homogeneous focus groups were conducted:

- Two focus groups with ECRs
- One focus group with academia/RPO representatives
- One focus group with industry representatives

In addition, structured interviews were conducted with selected stakeholders to deepen contextual interpretation. Participants were selected through purposive sampling based on deep-tech engagement, exposure to recruitment/supervision/mobility, and direct experience with academia–industry collaboration.

Discussions explored: operational experiences with Charter implementation, evaluation and career progression logics, mobility barriers and enablers, IP/publication tensions, mentoring structures, and inclusion dynamics. Qualitative data were anonymised and analysed thematically. The objective was not statistical generalisation but mechanism-oriented explanation of survey patterns. Focus group discussion guides are provided in **Annex II** – Focus Group Guides.

3.4 Analytical Framework: Realist CMO Logic

The analysis applies a realist evaluation approach structured around the Context–Mechanism–Outcome (CMO) framework. Rather than assessing whether Charter principles are formally adopted, the CMO lens examines:

- **Context:** structural conditions of deep-tech environments (project-based funding, industry coupling, infrastructure intensity, evaluation traditions, regulatory/IP regimes)
- **Mechanism:** institutional processes translating Charter principles into practice (recruitment, evaluation, mentoring, contract structures, mobility governance, knowledge governance procedures)
- **Outcome:** observable effects on stakeholders (employment predictability, career clarity, mentoring access, mobility feasibility, perceived recognition and fairness)

Triangulation was achieved through systematic comparison of survey patterns, qualitative explanations and national governance configurations to identify recurring ecosystem-level dynamics shaping Charter operationalisation.

3.5 Conceptual Alignment with ReserchComp

The needs analysis is conceptually aligned with **ResearchComp**, the European Competence Framework for Researchers. ResearchComp is used as an interpretative lens to contextualise ecosystem-level competence signals (e.g., IP literacy, governance awareness, innovation orientation) relevant to Charter operationalisation and to ensure coherence with the competence-oriented design logic of Task 2.2. It is not used as an individual assessment tool in Task 2.1.

3.6 Ethical Considerations and Limitations

The study complies with Horizon Europe ethical standards and GDPR requirements. Participation was voluntary and based on informed consent. All data were anonymised and reported in aggregated form; commercially sensitive information was excluded.

Differences in technological maturity, regulatory conditions and funding regimes may influence implementation dynamics beyond the scope of this sample. These limitations do not undermine analytical validity, which is grounded in triangulated evidence and structured CMO-based interpretation.

3.7 Methodological Toolkit for Replication and Scaling

In line with Horizon Europe Open Science principles and the project’s capacity-building objectives, this deliverable provides not only analytical findings but also structured research instruments developed under Task 2.1.

The annexed materials include:

– Survey questionnaire templates (ECRs, Academia, Industry versions)

– Focus group facilitation scenarios (ECRs, Academia, Industry versions)

These instruments are designed to enable replication, longitudinal monitoring, and contextual adaptation across widening and non-widening deep-tech ecosystems.

By making both results and methodological tools available, the project contributes to sustainable monitoring capacity for Charter implementation and supports evidence-based policy refinement beyond the consortium.

4 EMPIRICAL FINDINGS: STAKEHOLDER PERSPECTIVES ON CHARTER IMPLEMENTATION

This chapter presents stakeholder-level empirical evidence collected under Task 2.1. It synthesises quantitative survey data (n = 354) and qualitative insights from four focus groups (n = 24) and structured interviews across three stakeholder groups (n=15):

- Early-Career Researchers (ECRs)
- Research-Performing Organisations (RPOs)
- Industry representatives active in deep-tech domains

The purpose of this chapter is analytical at the stakeholder level. It identifies recurring patterns within each group concerning:

- working conditions and career sustainability
- evaluation and recognition practices
- mentoring and career guidance
- intersectoral mobility
- knowledge governance and intellectual property
- gender and inclusion dynamics

Cross-stakeholder triangulation and systemic interpretation are addressed in Chapter 5. Findings are structured thematically (rather than question-by-question) to foreground coherent patterns of experience and perception.

Detailed statistical tables and extended focus group analysis underpinning the findings presented in this chapter are provided in Annex III – Survey Statistics and Results and Annex IV Focus Groups Analytical Summary.

4.1 Early-Career Researchers (ECR Perspective)

The ECR dataset (n = 218) is dominated by PhD candidates (72.5 %), primarily in AI/ML (60.6 %) and advanced materials (20.2 %), while smaller shares are represented in robotics (9.2 %) and 5G/6G telecommunications (7.3 %). The gender distribution (77.1 % male; 22.9 % female) reflects the demographic composition typical of engineering-intensive deep-tech fields. Across survey responses and focus groups, ECRs combine high openness to collaboration with recurring tensions related to employment stability, evaluation logics and career guidance.

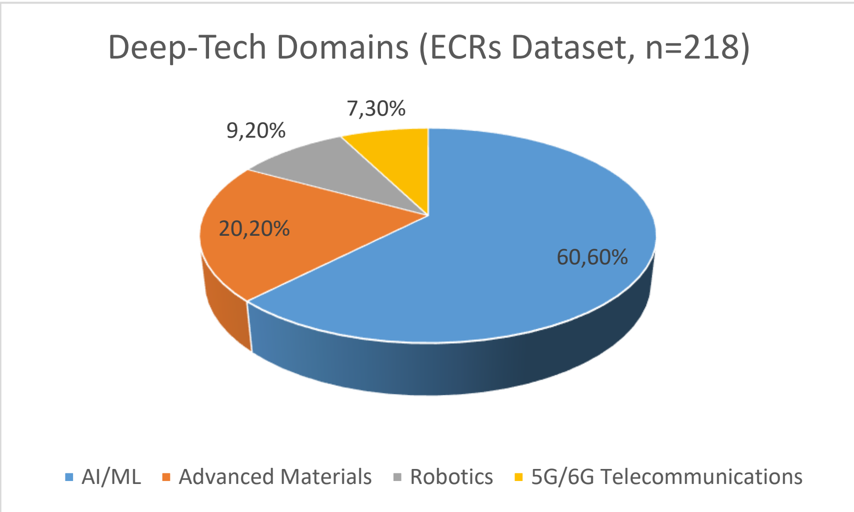

Figure 3: ECRs Deep-Tech Domains Percentage

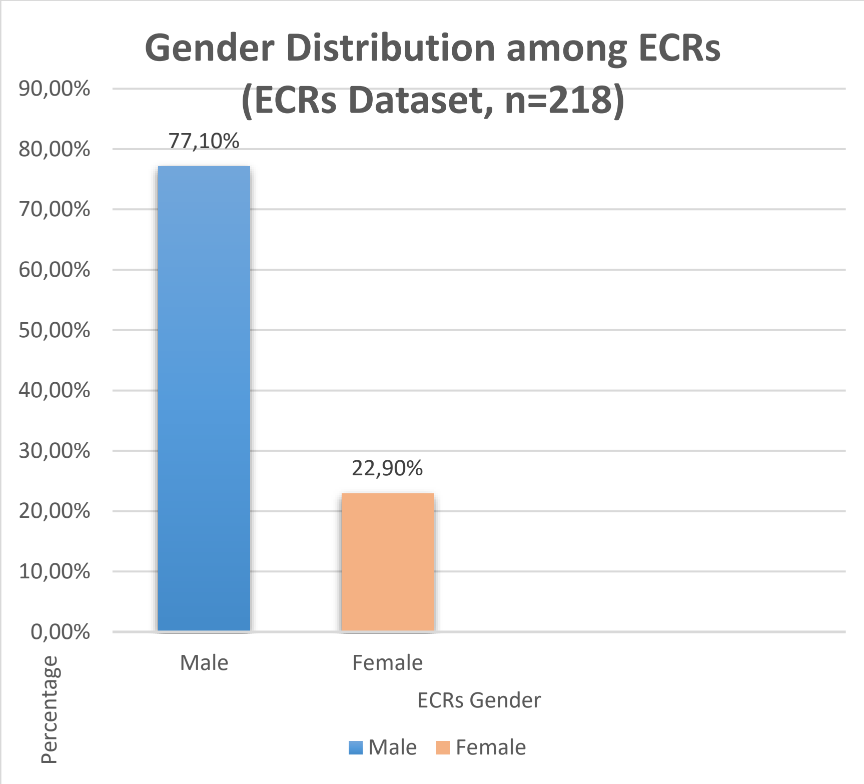

Figure 4: Gender distribution among ECRs

4.1.1 Employment Stability and Career Predictability

Recruitment procedures are perceived as transparent and merit-based (mean = 4.21/5), while clarity of long-term career pathways is weaker (mean = 3.36/5). Nearly half of respondents (48.6 %) identify unclear career progression as a primary barrier, and 32.1 % report pressure and uncertainty regarding future prospects.

Focus group discussions repeatedly connect this uncertainty to project-based funding cycles:

"On paper everything looks fair and transparent, but in reality your future depends on whether the next project gets funded."

The central concern is limited predictability beyond individual grant cycles (contract renewal, transitions between projects, and longer-term positioning).

4.1.2 Evaluation and Recognition of Merit

ECRs consistently describe publication output and grant acquisition as dominant indicators in academic progression. Respondents perceive a gap between policy rhetoric emphasising innovation and collaboration, and evaluation systems that remain predominantly bibliometric in practice:

"You are encouraged to collaborate with industry, but when it comes to evaluation, publications still matter most."

Applied contributions—patents/prototypes, interdisciplinary work, industry-engaged research and other translational outputs—are seen as encouraged but not systematically recognised in progression trajectories, creating uncertainty about how hybrid activities are valued.

4.1.3 Mentoring and Career Guidance

Survey results and qualitative insights point to uneven mentoring and career signalling. Scientific supervision is generally present, but structured guidance for non-academic or hybrid career paths is less systematic. Parallel RPO responses show relatively low ratings for mentoring programmes (mean ≈ 2.54/5) and the lowest rating for deep-tech-specific career development services (mean ≈ 2.28/5), aligning with ECR perceptions.

“My supervisor supports my research, but when I ask about career paths outside academia, there is no clear advice.”

Career advice beyond academia is often mediated by individual supervisors’ networks rather than institutionalised services.

4.1.4 Intersectoral Mobility and Transition Dynamics

Mobility is widely perceived as desirable: 79.8 % express definite or potential interest in industry placements. Reported barriers cluster around:

- different working cultures and expectations (47.7 %)
- lack of information about opportunities in the other sector (39.4 %)
- unclear transition pathways (37.6 %)
- concerns about recognition of external experience (22.9 %)

Focus group discussions highlight reintegration and signalling risks: “If you leave academia for industry, even for a short time, you risk being seen as less committed to research.” The pattern is openness to mobility combined with uncertainty about sequencing, recognition and institutional signals.

4.1.5 Knowledge Governance and Transversal Competence

ECRs report highest confidence in research integrity (mean = 3.50/5) and lowest confidence in intellectual property and patent regulation (mean = 2.51/5). Training exposure in governance-related areas is uneven: only 22.9 % report having received IP/patent training, while 24.8 % report no training across the listed governance domains. This points to a visible preparedness gap specifically in IP-sensitive deep-tech environments.

4.1.6 Gender and Inclusion Patterns

While 47.7 % report no inclusion barriers, challenges related to international inclusivity (21.1 %), language barriers (21.1 %) and gender bias (9.2 %) are reported. Focus groups do not indicate widespread explicit discrimination, but describe representation gaps, informal network dynamics and work–life tension pressures in male-dominated contexts. Reported challenges therefore appear linked to representation structures and field-specific conditions.

4.1.7 ECR Subgroup Checks (Robustness and Differentiation Patterns)

To test stability beyond aggregate averages, subgroup analyses were conducted across gender, country (where N allowed), deep-tech domain, and prior industry experience. Overall, subgroup differences are more visible in training-related and governance competence domains than in perceived procedural fairness; key weaknesses (IP confidence and mobility uncertainty) persist across subgroups.

Gender (male 77.1 %, n = 168; female 22.9 %, n = 50).

No meaningful gender differences appear in infrastructure access (mean 3.44/5 for both) or recruitment transparency (4.20/5 female; 4.21/5 male). Women report higher career pathway clarity (3.72/5 vs. 3.25/5) but lower satisfaction with training provision (2.84/5 vs. 3.25/5). Women report higher confidence in several governance domains (open science 3.52/5 vs. 3.24/5; AI ethics 3.52/5 vs. 3.14/5; GDPR 3.20/5 vs. 3.07/5; environmental sustainability 3.205/5 vs. 2.905/5). IP confidence remains low for both groups (2.56/5 female; 2.50/5 male).

Country-level (CZ/GR/ES; each ≥ 30 ECR respondents).

Recruitment transparency is consistently high across contexts (≈4.1–4.3/5). Differences are clearer in career pathway clarity and training adequacy: Spain highest, Czech Republic lower, Greece intermediate. IP/patent confidence remains low across all three (≈2.4–2.7/5). Career aspirations vary moderately: stronger academic orientation in the Czech sample and relatively higher industry/entrepreneurial orientation in Spain.

Domain-level (AI/ML n = 132; Advanced Materials n = 44; smaller Ns interpreted cautiously).
Advanced materials respondents report stronger industry exposure and slightly higher salience of IP-related issues; AI/ML respondents report higher confidence in AI ethics, but similarly low IP confidence. Career clarity and training adequacy vary moderately without extreme divergence.

Prior industry experience (Yes 21.1 %, n = 46; No 78.9 %, n = 172).

Those with prior industry experience report slightly higher career clarity and stronger industrial/hybrid orientation. Mobility barriers differ more clearly: respondents without industry experience more frequently report informational and pathway uncertainty, while those with prior exposure report fewer informational barriers but still emphasise cultural differences. IP confidence is marginally higher among those with prior industry experience but remains low overall.

Overall subgroup takeaway (ECRs).

Recruitment fairness is consistently high, while career predictability, IP literacy and structured mobility remain recurring concerns across subgroups.

Synthesis of the ECR Perspective

Across survey responses (n = 218) and focus group discussions, ECRs demonstrate:

- strong identification with research integrity and scientific standards,
- high perceived recruitment fairness (mean = 4.21/5),
- openness to intersectoral collaboration (79.8 % positive toward industry placements).

However, recurring tensions concentrate in three areas. First, career predictability remains moderate (mean = 3.36) and unclear progression pathways are widely reported (48.6 %), pointing to funding-dependent employment continuity as a primary concern. Second, evaluation systems are perceived as publication-centred, with limited formal recognition of applied and industry-engaged contributions within academic progression. Third, mobility is attractive but procedurally and reputationally uncertain, shaped by cultural differences (47.7 %), informational barriers (39.4 %) and unclear transition pathways (37.6 %). A consistent transversal governance competence gap is visible in IP/patent confidence (mean = 2.51/5) and low exposure to IP training (22.9 %). Subgroup checks confirm that these tensions persist across countries, domains and background characteristics.

4.2 Research-Performing Organisations (RPO Perspective)

The RPO sample (n = 78) includes universities (66.7 %), public research centres (25.6 %) and private research organisations (7.7 %) across 16 European countries. Approximately 35.9 % report primary engagement in deep-tech domains and 48.7 % partial engagement. Formal Charter alignment is substantial: 38.5 % hold the HR Excellence in Research Award and 20.5 % are in progress.

4.2.1 Formal Alignment and Institutional Commitment

RPO respondents report formal adherence to transparent recruitment, equal opportunity policies, research integrity standards and structured HR frameworks (often linked to HRS4R). Recruitment governance is described as mature and aligned with international standards, consistent with ECR perceptions of procedural fairness.

However, 46–48 % indicate “insufficient information” when asked about specific Charter implementation challenges, suggesting uneven internal dissemination and variable embedding across organisational units. Qualitative evidence points to capacity as a mediating condition: “We have integrated the Charter principles into our HR policies, but implementation depends heavily on available resources.”

4.2.2 Funding Structures and Project Dependency

RPO stakeholders identify funding structures as the primary constraint affecting Charter operationalisation in deep-tech contexts. Competitive project-based funding, industry co-financing and infrastructure-intensive research models restrict flexibility in offering longer contracts and predictable progression, particularly for ECRs. Institutions frame instability primarily as an effect of external funding volatility and limited long-term HR planning horizons.

4.2.3 Evaluation Practices and Career Development Support

RPOs report evaluation systems that remain anchored in publication output, citations, grant acquisition and project leadership. While institutions increasingly recognise interdisciplinarity, technology transfer and industry engagement, integration into formal promotion criteria remains uneven.

Support structures for ECRs show moderate formalisation (1–5 scale):

- role/evaluation guidelines: 3.18
- HR guidance: 2.64
- mentoring programmes: 2.54
- onboarding: 2.49
- supervisor training: 2.41
- deep-tech-specific career services: 2.28

The low score for deep-tech-specific career services aligns with ECR accounts of limited structured signalling for hybrid/non-academic trajectories.

4.2.4 Mobility Governance and Cooperation

Industry collaboration is high: 46.2 % report regular strategic partnerships and 38.5 % frequent collaboration (84.7 % combined). Mobility feasibility is constrained by:

- administrative/bureaucratic barriers (59.0 %)
- IP/legal and funding constraints (43.6 %)
- differences in working conditions and career structures (38.5 %)
- limited institutional support for mobility (23.1 %)

RPOs support mobility in principle (including co-supervised doctorates and joint projects), but structured reintegration mechanisms for cross-sector transitions are often underdeveloped.

4.2.5 Institutional Differentiation Patterns (RPOs)

Subgroup analyses indicate that institutional model and governance capacity influence the *form* of constraints, while core bottlenecks remain widely shared.

- **Organisation type.** Collaboration is high across types (universities 85 %; research centres 80 %; private 100 % regular/frequent). Universities show stronger HRS4R adoption; research centres more frequently emphasise regulatory/IP constraints; universities more often emphasise administrative constraints.
- **Institution size.** Large institutions report stronger formalisation but higher administrative barriers; smaller institutions show slightly lower formalised ECR support but somewhat fewer administrative mobility barriers.
- **Country-level.** CZ/GR more often emphasise administrative barriers; ES more often emphasises IP/legal constraints. Training needs are broadly consistent.
- **Deep-tech engagement intensity.** Primary deep-tech institutions report stronger exposure to IP/legal constraints and mobility pressures; less specialised institutions more often cite staff capacity and general administrative burden.
- **HRS4R status.** HR Award institutions report stronger internal HR structuring, yet mobility barriers and funding volatility remain; non-award institutions report more capacity and funding constraints and more "insufficient information" responses.

4.2.6 Synthesis of the RPO Perspective

RPOs combine strong formal endorsement of Charter principles (including transparent recruitment and HRS4R-linked governance) with high industry collaboration (84.7 % regular/frequent). Implementation challenges concentrate in structurally sensitive domains: project-based funding dependency and limited long-term HR planning; publication and grant-centred evaluation regimes; complex IP/legal environments; and administrative burden shaping mobility. Subgroup analyses show that governance maturity improves internal structuring but does not remove ecosystem constraints linked to funding and mobility feasibility. These patterns converge with ECR accounts (uncertainty, limited career signalling) and industry accounts (transaction costs, IP sequencing and timeline friction), reflecting different vantage points on shared structural mechanisms.

4.3 Industry Perspective

The industry sample (n = 58) includes large enterprises (34.5 %), SMEs (31.0 %), small companies (24.1 %) and startups (10.3 %), with strong representation in AI/ML (75.7 %) and telecommunications (44.8 %). Industry respondents value scientific expertise while emphasising applied orientation and governance literacy.

4.3.1 Competence Expectations Beyond Technical Depth

Industry does not characterise doctoral researchers as technically weak. Reported deficits relate mainly to transversal governance and business-facing competences:
• IP and regulatory understanding (mean = 3.32/5 lacking)
• business and commercial awareness (mean = 3.28/5 lacking)
• project and time management (mean = 3.04/5 lacking)
By contrast, problem-solving is not rated as critically lacking (mean = 2.16/5).

Qualitative accounts emphasise adaptability and cross-functional integration: "We don't need someone who knows only one thing perfectly. We need someone who can connect fields and learn fast."

"Technical expertise is good, but it can be acquired. Flexibility and teamwork are often more decisive."

4.3.2 Intellectual Property and Knowledge Governance

Industry repeatedly foregrounds protection-before-publication sequencing: "In academia you publish first. In industry the first question is: should this be protected?" Respondents emphasise that this is not a disagreement with openness, but an operational requirement in IP-sensitive domains. They also call for earlier IP literacy in doctoral training: "You have to teach early-career researchers to think about IP from the beginning."

4.3.3 Time-to-Market and Performance Logic

Industry stresses deliverable-driven work and time-to-market constraints: "In academia you can aim for perfection. In industry you need something that works and you need it on time."

This performance logic shapes expectations of researchers transitioning between sectors: scientific rigour is valued, but adaptation to applied project cycles is required.

4.3.4 Evaluation of Academic Experience

Industry generally values a PhD as a signal of analytical depth and autonomy, but recruitment emphasises applied fit: communication, collaboration, demonstrated autonomy and implementation experience.

"Academic background is good, but fit and flexibility matter more."

4.3.5 Intersectoral Cooperation with Academia

Collaboration intensity is high: 62.1 % report strategic collaboration with academia. Hosting interest is substantial: 51.7 % "yes" and 13.8 % "maybe". Collaboration barriers include slow academic timelines (mean ≈ 3.31/5) and administrative complexity (≈ 3.07/5). Enabling conditions are strongly feasibility-oriented: 79.3 % identify financial support as decisive for hosting ECRs, and 62.1 % cite procedural simplification as critical.

4.3.6 Company Differentiation Patterns (Industry)

Company size influences absorptive capacity and exposure to bureaucracy. Large enterprises report more formalised onboarding and higher sensitivity to administrative/timeline friction; SMEs emphasise feasibility conditions (financial support and simplified procedures); small and micro firms more frequently cite capacity and resource constraints. Despite size differences, enabling conditions (funding support, simplified procedures, IP clarity) are consistently emphasised.

Synthesis of the Industry Perspective

Industry respondents show high appreciation of doctoral-level competence and active engagement in collaboration (62.1 % strategic cooperation; 79.3 % participation in open innovation). Constraints cluster around feasibility and sequencing: mobility and hosting are highly sensitive to transaction costs (administration, timelines) and financial conditions (79.3 % require support), while knowledge governance is shaped by protection-before-publication logic in IP-sensitive contexts. The perceived competence gap concerns transversal governance and commercial readiness (IP/regulatory understanding and business awareness), not core scientific ability. Differences by firm size reflect absorptive capacity, but the main enabling levers—procedural simplification, IP clarity and financial support—remain shared. This industry vantage point complements ECR and RPO perspectives and completes the stakeholder-level evidence base for CMO-based systemic interpretation in Chapter 5.

5 CROSS-STAKEHOLDER TRIANGULATION (CMO SYNTHESIS)

To interpret the empirical findings beyond descriptive reporting, the analysis applies a realist Context–Mechanism–Outcome (CMO) framework. Rather than assessing formal Charter compliance, the chapter examines how structural characteristics of deep-tech research environments interact with institutional processes to generate observable career, governance and mobility outcomes.

Figure 5 visualises this analytical logic. The five CMO patterns presented below illustrate how ecosystem-level conditions shape the practical operationalisation of Charter principles across stakeholder groups. The thematic convergence underlying the CMO patterns is detailed in Annex V. The complete CMO analytical matrix underlying this synthesis is presented in Table 3: CMO analytical matrixTable 3.

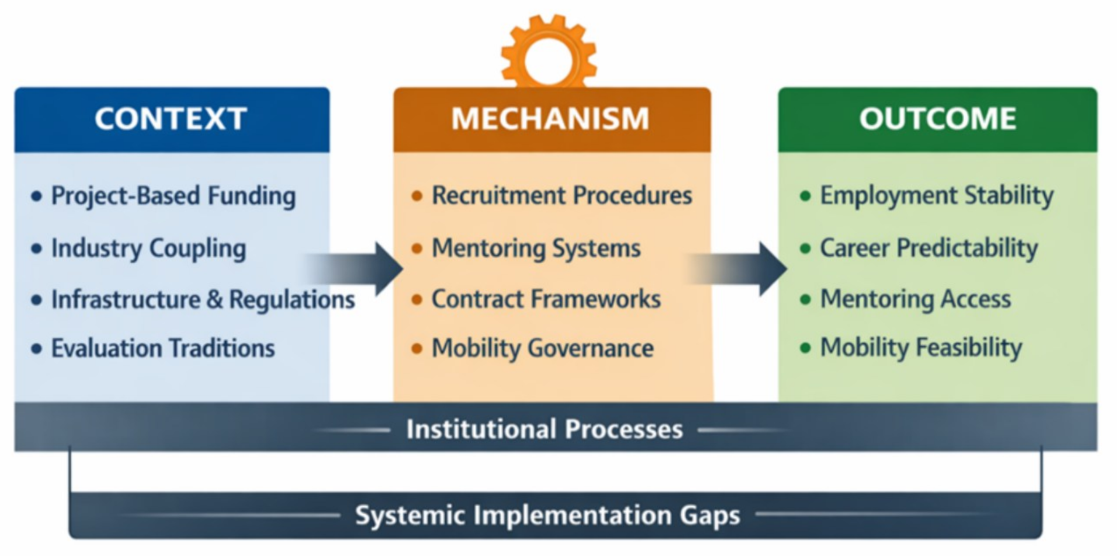

Figure 5: Context-Mechanism-Outcome Analytical Model

5.1 CMO Pattern 1: Project-Based Funding and Career Predictability

Context

Deep-tech research is structurally dependent on competitive, project-based funding and infrastructure-intensive grant cycles. Within the ECR sample (n = 218), 72.5 % are PhD candidates operating within fixed-term, externally funded arrangements. Academic institutions similarly identify funding dependency as a structural constraint, with 33.3 % reporting insufficient funding and 25.6 % citing limited staff capacity as barriers to effective Charter implementation.

Table 3: CMO analytical matrix

CMO Pattern	Context	Mechanism	Outcome – ECR	Outcome – RPO	Outcome – Industry
Pattern 1: Project-Based Funding and Career Predictability	Infrastructure-intensive deep-tech research; high reliance on competitive project funding; limited core institutional funding	Employment contracts tied to grant cycles; renewal dependent on funding success; limited institutional buffering	Employment instability; limited long-term predictability; difficulty in life planning	Structural constraint in offering long-term contracts; limited flexibility despite normative commitment	Emphasis on adaptability to non-linear career paths; awareness of academic sequencing constraints
Pattern 2: Evaluation Metrics and Recognition of Merit	Publication-dominant academic evaluation regimes; innovation-oriented policy rhetoric	Promotion criteria prioritising bibliometrics and grant acquisition; applied outputs unevenly integrated	Perceived misalignment between innovation discourse and evaluation practice; strategic prioritisation of publications	Difficulty recalibrating evaluation systems without risking competitiveness	Observation of limited formal recognition of applied and translational competences within academia
Pattern 3: Knowledge Governance – Openness vs Protection	Hybrid governance regime combining open science and IP protection; frequent academia–industry collaboration	Early publication incentives vs protection-before-disclosure requirements; uneven IP literacy	Uncertainty about publication timing and IP considerations	Administrative and legal mediation burden; complexity in IP negotiation	Emphasis on strategic protection sequencing; identification of IP competence gaps
Pattern 4: Intersectoral Mobility and Cultural Translation	Policy promotion of mobility; sector-specific performance regimes; differing sequencing logics	Limited reintegration mechanisms; inconsistent recognition of industrial experience; procedural complexity	Perceived reputational risk; uncertainty regarding academic recognition of industrial experience	Support for mobility in principle; limited structured reintegration pathways	Positive valuation of academic training; expectation of rapid adaptation to applied project environments
Pattern 5: Gender Imbalance in Deep-Tech Context	Persistent male dominance in infrastructure-intensive technological domains; representation asymmetry	Informal network effects; pipeline constraints; cumulative evaluation pressure	Limited representation; structural retention challenges; informal network barriers	Formal equality commitments; limited leverage over recruitment pool asymmetry	Recruitment pool constraints in deep-tech specialisations; diversity aspirations under

Mechanism

Under conditions of grant-dependent employment, career development becomes closely tied to funding continuity rather than to institutional career sequencing. Although recruitment procedures are perceived as transparent and merit-based (mean = 4.21/5), clarity of long-term career pathways is significantly weaker (mean = 3.36/5). Nearly half of ECR respondents (48.6 %) identify unclear progression pathways as a key barrier, and 32.1 % report pressure and uncertainty regarding future prospects.

The mechanism activated in this context is the decoupling of procedural fairness from long-term predictability: formal transparency does not translate into stable career horizons.

Outcome

As a result, early-career researchers experience limited career predictability as a systemic feature of project-driven employment. Increased funding for early-career researchers is rated as the most impactful intervention (mean = 4.20/5), reinforcing the perception that career stability depends primarily on funding architecture rather than on procedural reform. Career uncertainty thus emerges as a structurally conditioned outcome rather than as an institutional compliance deficit.

Interpretation

Formal alignment with Charter principles in recruitment and transparency coexists with structurally limited career predictability. The constraint lies in funding architecture and grant-dependent employment models rather than in deficiencies of procedural governance. Career uncertainty therefore reflects systemic funding volatility within deep-tech ecosystems.

5.2 CMO Pattern 2: Evaluation Metrics and Recognition of Merit

Context

Deep-tech research operates at the intersection of academic and market-oriented performance regimes. Academic career progression remains predominantly publication and grant-driven, whereas industry performance is assessed through applied problem-solving, intellectual property generation, product development and responsiveness to market timelines.

Although collaboration intensity between academia and industry is high (84.7 % of academic institutions report regular or frequent collaboration; 62.1 % of companies describe collaboration as very active and strategic), the criteria used to recognise achievement differ substantially across sectors.

Mechanism

The coexistence of divergent evaluation logics activates a recognition misalignment mechanism. Academic evaluation systems prioritise peer-reviewed publications, grant acquisition and disciplinary reputation, while industry frameworks emphasise applied output, commercial feasibility and implementation speed.

As a result, researchers navigating hybrid environments face uncertainty regarding how industry-oriented achievements—such as patent development, prototype creation or intersectoral collaboration—translate into academic career progression. Focus group discussions confirm that academic promotion criteria rarely assign equivalent weight to applied or intersectoral contributions.

Outcome

This misalignment results in the partial institutionalisation of hybrid merit recognition. While recruitment procedures are widely perceived as transparent (mean = 4.21/5), clarity regarding long-term recognition of diverse achievements remains limited (mean = 3.36/5).

Industry respondents identify deficits primarily in regulatory/IP awareness (mean = 3.32/5) and business orientation (mean = 3.28/5), rather than in core technical competence (problem-solving rated 2.16 on the "lacking" scale). Academic institutions simultaneously prioritise training in project management (71.8 %), communication and leadership (61.5 %), and industry-oriented practical skills (59.0 %).

Together, these findings indicate that evaluation frameworks do not yet fully align with the competence and contribution profiles required in deep-tech ecosystems.

Interpretation

The central gap does not concern recruitment transparency but the cross-sector alignment of merit recognition systems. Without explicit integration of applied and intersectoral criteria into institutional evaluation frameworks, hybrid academic–industry career trajectories remain structurally under-recognised, despite high collaboration intensity.

5.3 CMO Pattern 3: Knowledge Governance – Openness versus Protection

Context

Deep-tech research operates in knowledge environments where scientific openness coexists with intellectual property sensitivity. EU research policy promotes Open Science principles, transparency and FAIR data practices, while deep-tech innovation cycles frequently depend on patent protection, confidentiality agreements and controlled dissemination of results.

Survey results indicate uneven governance-related training exposure among ECRs. While 45.9 % report training in research integrity and 39.4 % in Open Science, only 22.9 % report having received training in intellectual property and patent regulation. Confidence levels reflect this asymmetry: ECRs report highest confidence in research integrity (mean = 3.50/5) and Open Science (mean = 3.30/5), but lowest confidence in IP and patent regulation (mean = 2.51/5).

Mechanism

The coexistence of openness mandates and protection requirements activates a governance negotiation mechanism. Researchers must continuously balance publication expectations, patent timing and ownership considerations within collaborative projects.

Academic environments incentivise early dissemination and visibility, whereas industry partners require delayed disclosure and strategic protection of commercially sensitive findings. This dual incentive structure generates procedural ambiguity, particularly for early-career researchers navigating both academic performance expectations and IP-sensitive collaborations.

Outcome

As a result, knowledge governance in deep-tech environments becomes structurally negotiated rather than procedurally standardised. ECRs report uncertainty regarding when and how research outputs should be published or protected, especially in industry-collaborative settings. Academic institutions identify IP/legal constraints as a significant collaboration and mobility barrier (43.6 %), indicating that governance complexity extends beyond individual competence gaps.

Open Science norms are relatively well embedded; however, the operational integration of protection logic remains uneven. The stabilised outcome is a hybrid governance environment in which openness and protection must be continuously reconciled at project level.

Interpretation

The core issue is not resistance to Open Science principles nor a general lack of ethical awareness. Rather, deep-tech ecosystems require governance frameworks capable of aligning publication practices, IP management and intersectoral collaboration procedures.

Effective Charter implementation in deep-tech domains therefore depends on institutional mechanisms that reduce procedural ambiguity while preserving both openness and strategic protection.

5.4 CMO Pattern 4: Intersectoral mobility and Cultural Translation

Context

Deep-tech ecosystems are characterised by high levels of academia–industry collaboration but structurally differentiated institutional cultures. While joint projects are frequent, the organisational logics governing employment, performance evaluation, risk management and decision-making differ substantially between sectors. [10]

Survey data confirm strong collaboration intensity:

- 84.7 % of academic institutions report regular or frequent collaboration with industry.
- 62.1 % of companies describe collaboration as very active and strategic.

Despite this, mobility barriers remain consistently reported across stakeholder groups.

Mechanism

Intersectoral mobility activates a cultural translation mechanism shaped by misaligned organisational logics. Project collaboration does not require full integration of employment models, evaluation systems or contractual frameworks; mobility does.

Academic institutions identify administrative and bureaucratic barriers (59.0 %) and IP/legal constraints (43.6 %) as major obstacles. Industry respondents report slow academic timelines (mean = 3.31/5) and limited structural flexibility (mean = 3.21/5).

From the ECR perspective, mobility is associated with informational and cultural uncertainty:

- 47.7 % report differences in working style and expectations as a key obstacle.
- 39.4 % indicate insufficient knowledge about opportunities in the other sector.
- 37.6 % state that pathways between sectors are unclear.

These factors collectively generate a cultural translation gap, where skills, achievements and career expectations are not immediately legible across institutional contexts.

Outcome

The stabilised outcome is a condition of high willingness but structurally fragile mobility. Although 79.8 % of ECRs express definite or potential willingness to engage in industry placements, formal transition pathways remain underdeveloped.

Institutions report limited dedicated mobility support structures (23.1 % identify lack of institutional support as a barrier), while companies emphasise the need for financial support (79.3 %) and simplified procedures (62.1 %) to host ECRs.

As a result, intersectoral mobility remains episodic and project-bound rather than embedded within stable career sequencing mechanisms.

Interpretation

The core constraint is not weak cooperation but insufficient structural and cultural alignment between sectors. High collaboration intensity does not automatically translate into integrated career pathways.

Effective Charter implementation in deep-tech environments therefore requires institutional mechanisms that reduce administrative friction, clarify cross-sector career valuation and establish structured reintegration pathways. Without such alignment, mobility remains aspirational rather than systemically embedded.

5.5 CMO Pattern 5: Gender Imbalance in DeepTech Context

Context

Deep-tech domains remain structurally male-dominated. Within the ECR sample (n = 218), 77.1 % identify as male and 22.9 % as female, reflecting substantial gender imbalance at early career stages.

At institutional level, 84.6 % of academic organisations report implementing a Gender Equality Plan (GEP), indicating formal compliance with EU requirements and Charter principles. However, formal policy alignment does not automatically translate into structural parity within deep-tech research environments.

Mechanism

The persistence of gender imbalance appears to operate through a structural exposure mechanism rather than through overt procedural discrimination. Deep-tech research is characterised by project-based employment, high workload intensity, infrastructure dependency and mobility expectations.

Survey data show no significant gender differences in perceived recruitment transparency (female mean = 4.20/5; male mean = 4.21/5) or infrastructure access (mean = 3.44/5 for both groups), suggesting broad perceptions of procedural fairness.

However, structural conditions—such as competitive funding cycles, mobility demands and high-intensity project environments—may differentially affect long-term retention and career sustainability. Focus group discussions highlighted workload intensity and funding volatility as stress factors potentially influencing work–life balance and career continuity.

Outcome

The observable outcome is persistent underrepresentation rather than widespread reported discrimination. Among ECRs, 47.7 % report no observed inclusion barriers, while 9.2 % indicate gender bias and 8.3 % report harassment or inappropriate behaviour. Language and international integration challenges (21.1 %) are reported more frequently than explicit gender bias.

Institutional respondents rate gender imbalance and diversity in leadership at moderate levels of seriousness (means ≈2.4–2.8/5), indicating recognition of imbalance without classifying it as an acute systemic crisis.

Interpretation

In deep-tech ecosystems, gender imbalance manifests primarily through structural participation asymmetry rather than procedural inequity. Recruitment processes are widely perceived as fair, and formal gender equality mechanisms are in place.

However, domain-specific structural conditions—particularly project-based volatility, workload intensity and mobility expectations—may reinforce cumulative attrition risks for underrepresented groups.

Effective Charter implementation therefore requires attention not only to formal equality compliance but also to structural retention mechanisms within high-intensity research environments.

6 MAPPING CHARTER IMPLEMENTATION IN DEEP TECH CONTEXT

6.1 Mapping Logic

This chapter maps the systemic CMO patterns identified in Chapter 5 onto the core implementation domains of the European Charter for Researchers. The objective is not to restate stakeholder evidence, but to assess how ecosystem-level structural mechanisms condition the practical operationalisation of specific Charter principles in deep-tech environments. The full Charter-to-evidence mapping matrix is provided in Table 4.

Building on the realist analytical framework outlined in Empirical Findings: Stakeholder Perspectives on Charter Implementation, the mapping follows a structured logic:

- CMO patterns identify recurrent structural constraints and enabling conditions.
- These mechanisms are assessed against relevant Charter implementation domains.
- Areas of formal alignment, operational strength and structural vulnerability are identified.

Rather than evaluating formal compliance alone, the analysis examines how funding architectures, evaluation regimes, knowledge governance structures and mobility mechanisms mediate the effective implementation of Charter principles.

The mapping demonstrates that implementation gaps are concentrated in structurally sensitive domains shaped by deep-tech-specific ecosystem conditions, rather than evenly distributed across Charter principles. This structural clustering effect provides the analytical bridge between empirical needs analysis (Task 2.1) and subsequent framework development.

6.2 Working Conditions and Career Sustainability

Relevant Charter Domains:

Working conditions, stability of employment, career development, recognition of diverse career path

Table 4: Charter-to-evidence mapping matrix

Charter Pillar	Relevant Principle	Observed Implementation Status in Deep-Tech Context	Related CMO Pattern	Identified Structural Gap	Framework Design Implication
Working Conditions	Stability of employment	Formal alignment strong; operational stability constrained by project-based funding	Pattern 1	Funding architecture limits long-term career predictability	Funding-resilient career structures
Career Development	Sustainable career progression; access to mentoring	Recruitment transparency strong; mentoring uneven; limited buffering between grants	Pattern 1 & 4	Limited institutional buffering and sequencing clarity	Structured career sequencing mechanisms
Recognition of Merit	Comprehensive recognition of diverse contributions	Publication-dominant evaluation; applied outputs inconsistently recognised	Pattern 2	Evaluation inertia; under-recognition of translational outputs	Evaluation alignment with innovation practice
Assessment Systems	Transparent and fair performance evaluation	Formal criteria clear; innovation rhetoric partially misaligned with metrics	Pattern 2	Bibliometric dominance persists	Balanced performance frameworks
Dissemination & Exploitation	Open science; responsible knowledge transfer	Strong openness commitment; hybrid IP governance creates operational ambiguity	Pattern 3	Publication vs protection sequencing tension	Structured hybrid knowledge governance
Intellectual Property	Responsible exploitation of results	Mediation structures exist; IP literacy uneven among ECRs	Pattern 3	Limited systematic IP competence development	Integrated IP literacy frameworks
Intersectoral Mobility	Mobility facilitation and recognition	Strategic support strong; reintegration pathways underdeveloped	Pattern 4	Mobility sequencing misalignment	Institutionalised mobility pathways
Career Diversity	Equal recognition of non-academic experience	Industrial experience inconsistently valued in academic promotion	Pattern 4	Limited formal reintegration recognition	Evaluation recognition of sectoral experience
Gender Equality	Equal opportunity; inclusive environments	Formal policies strong; representation imbalance persists in deep-tech domains	Pattern 5	Pipeline and retention asymmetry	Domain-sensitive inclusion strategies
Diversity & Inclusion	Inclusive participation and leadership pathways	Informal network effects; structural leadership imbalance	Pattern 5	Structural progression imbalance	Mentoring and leadership pipeline reinforcement

The evidence indicates strong formal alignment with Charter principles related to fair recruitment and non-discrimination. Recruitment transparency is rated highly by Early-Career Researchers (mean = 4.21), suggesting robust procedural fairness at entry level. In addition, 38.5 % of surveyed institutions hold the HR Excellence in Research Award and a further 20.5 % are in progress, reinforcing the conclusion that formal Charter alignment is institutionally embedded.

However, structural constraints linked to project-based funding significantly affect the operationalisation of career sustainability principles. As demonstrated in CMO Pattern 1, 72.5 % of ECR respondents are PhD candidates operating within fixed-term arrangements, and 48.6 % identify unclear career progression pathways as a primary barrier. Institutions themselves report insufficient funding (33.3 %) and limited staff capacity (25.6 %) as key implementation constraints.

Deep-tech environments amplify this tension due to:

- High infrastructure costs
- Grant-cycle dependency
- Competitive funding intensity

Employment contracts are frequently tied to external funding cycles, limiting institutional flexibility to offer long-term stability. While normative commitment to sustainable careers is evident, funding architecture mediates practical implementation capacity.

Implementation Status Assessment:

- Formal compliance: Strong (high recruitment transparency; widespread HR Award uptake)
- Operational stability mechanisms: Structurally constrained
- Buffering capacity against funding volatility: Limited

This domain represents a structurally sensitive implementation area requiring systemic funding-level alignment beyond institutional policy commitment.

6.3 Evaluation and Recognition of Merit

Relevant Charter Domains:

Recognition of diverse contributions, merit-based assessment, career progression transparency.

Charter principles promote comprehensive recognition of research outputs, including interdisciplinary collaboration, knowledge transfer and societal impact. Within surveyed institutions, formal endorsement of merit-based evaluation is strong; however, evaluation systems remain predominantly publication- and grant-centred in practice.

CMO Pattern 2 demonstrates that differing recognition logics operate across sectors. While recruitment fairness is widely perceived (mean = 4.21/5), clarity of long-term career progression remains moderate (mean = 3.36/5), suggesting that recognition trajectories beyond entry-level assessment are less structured.

Industry respondents identify understanding of IP and regulatory frameworks (mean = 3.32/5) and business awareness (mean = 3.28/5) as the most lacking competences among candidates, while core technical competence is not perceived as critically deficient (problem-solving rated 2.16/5 on the “lacking” scale). Academic institutions similarly prioritise training in project management (71.8 %), communication and leadership (61.5 %) and industry-oriented practical skills (59.0 %), indicating awareness that evaluation systems may not fully reflect innovation-oriented contributions.

Applied outputs such as:

- Patents
- Prototypes
- Industry collaboration
- Technology transfer activities

are strategically acknowledged but unevenly integrated into formal promotion criteria.

Implementation Status Assessment:

- Formal endorsement of merit principles: Strong
- Integration of applied and innovation-oriented outputs into evaluation frameworks: Uneven
- Alignment between innovation strategy and performance metrics: Partial

This domain represents a key leverage point for strengthening Charter operationalisation in deep-tech ecosystems.

6.4 Knowledge Dissemination and Intellectual Property

Relevant Charter Domains:

Dissemination and exploitation of results, open science, research integrity, innovation engagement.

Deep-tech environments operate within hybrid knowledge governance regimes combining Open Science expectations and intellectual property protection requirements.

CMO Pattern 3 demonstrates structural asymmetry in governance exposure. While 45.9 % of ECRs report training in research integrity and 39.4 % in Open Science, only 22.9 % report training in intellectual property and patent regulation. Correspondingly, confidence in IP-related knowledge is lowest among surveyed governance domains (mean = 2.51/5).

Academic institutions identify IP/legal concerns as a major structural constraint affecting collaboration and mobility (43.6 %). Focus group discussions further illustrate tension between publication incentives and protection-before-publication sequencing in industry-coupled projects.

This dual governance context creates operational ambiguity rather than normative conflict. Commitment to research integrity and openness is strong, but structured institutional mediation of IP literacy and dissemination sequencing remains uneven.

Implementation Status Assessment:

- Commitment to research integrity and openness: Strong
- Institutional mediation of IP and dissemination sequencing: Variable
- Systematic integration of IP competence development: Limited

Effective Charter implementation in this domain requires clearer procedural alignment between publication incentives, IP governance frameworks and collaborative research agreements.

6.5 Intersectoral Mobility and Career Diversity

Relevant Charter Domains:

Mobility, career diversity, recognition of non-academic pathways, equal treatment across sectors.

Intersectoral collaboration is widespread. 84.7 % of academic institutions report regular or frequent collaboration with industry, and 62.1 % of companies describe collaboration as very active and strategic. However, CMO Pattern 4 demonstrates that collaboration intensity does not automatically translate into systemic mobility.

Academic institutions identify administrative and bureaucratic barriers (59.0 %) and IP/legal constraints (43.6 %) as key obstacles to mobility. Industry respondents report slow academic timelines (mean = 3.31/5) and limited flexibility of academic structures (mean = 3.21/5) as collaboration constraints. From the ECR perspective, 47.7 % cite differences in working style and expectations, 39.4 % lack knowledge about cross-sector opportunities, and 37.6 % indicate unclear transition pathways.

Despite high willingness — 79.8 % express openness to industry placements — structured reintegration pathways and formal recognition of industrial experience remain weakly institutionalised.

Implementation Status Assessment:

- Strategic support for mobility: Strong
- Operational reintegration pathways: Weak
- Recognition of industrial experience in academic progression: Inconsistent

Mobility implementation gaps are primarily procedural and cultural rather than attitudinal.

6.6 Equality and Inclusion in Deep-Tech Context

Relevant Charter Domains:

Gender equality, inclusion, equal opportunity, diversity in research environments.

Formal equality commitments are widely embedded in institutional governance structures, with 84.6 % of surveyed institutions reporting implementation of a Gender Equality Plan.

However, the ECR sample reflects substantial gender imbalance (77.1 % male; 22.9 % female), consistent with engineering-intensive deep-tech domains. While 47.7 % report no observed inclusion barriers, moderate levels of gender bias (9.2 %) and harassment (8.3 %) are reported. Institutions rate gender imbalance and diversity in leadership at moderate seriousness levels (means approximately 2.4–2.8/5).

The evidence suggests that challenges relate primarily to structural underrepresentation and retention exposure rather than widespread procedural inequity.

Implementation Status Assessment:

- Formal equality policy alignment: Strong
- Deep-tech-specific inclusion mechanisms: Underdeveloped
- Retention and leadership pipeline support: Structurally sensitive

Charter implementation in this domain requires context-sensitive interventions tailored to technological fields characterised by persistent participation asymmetries.

6.7 Overall Mapping Assessment

The mapping exercise confirms that Charter implementation in deep-tech environments is not hindered by lack of normative endorsement. Across domains, formal alignment is generally robust, supported by widespread HR Award uptake, high recruitment transparency and institutional equality commitments.

However, implementation gaps cluster in structurally sensitive areas where:

- Funding regimes constrain employment stability
- Evaluation systems remain partially publication-centred
- Knowledge governance operates in hybrid openness–protection regimes
- Mobility lacks institutionalised reintegration mechanisms
- Gender imbalance reflects structural participation asymmetries

This clustering effect confirms the CMO-based interpretation that Charter operationalisation in deep-tech contexts is conditioned more by ecosystem architecture than by institutional reluctance.

Strengthening Charter implementation in deep-tech ecosystems therefore requires systemic alignment of funding models, evaluation frameworks, knowledge governance procedures and mobility mechanisms rather than additional normative articulation.

The mapping provides the analytical foundation for identifying priority structural intervention areas in the subsequent chapter.

7 STRUCTURAL GAPS AND IDENTIFIED NEEDS

Building on the CMO analysis and Charter mapping, this chapter consolidates five structurally grounded implementation gaps directly corresponding to the patterns identified in Mapping Charter Implementation in Deep Tech Context. These gaps do not reflect normative resistance to Charter principles; rather, they reveal systemic misalignment between governance frameworks and the structural characteristics of deep-tech ecosystems. [7]

7.1 Gap 1: Funding Architecture and Career Predictability

Evidence

High recruitment transparency coexists with moderate career clarity and strong dependence on project-based employment structures (see Mapping Charter Implementation in Deep Tech Context).

Mechanism

Short-term grant cycles and infrastructure-intensive funding models limit institutional capacity to provide employment continuity and long-term HR planning.

Intervention Direction

Promote funding-resilient career sequencing models and structural buffering mechanisms between grant cycles.

7.2 Gap 2: Evaluation Misalignment in Innovation-Oriented Contexts

Evidence

Evaluation remains publication and grant-centred, while applied outputs (patents, prototypes, industry collaboration) are unevenly integrated into promotion systems. (see Mapping Charter Implementation in Deep Tech Context).

Mechanism

Divergent recognition logics across academia and industry create ambiguity regarding merit valuation in hybrid career trajectories.

Intervention Direction

Recalibrate evaluation frameworks to formally recognise innovation-oriented and intersectoral contributions.

7.3 Gap 3: Hybrid Knowledge Governance and IP Mediation

Evidence

IP training exposure remains limited and confidence in patent regulation is lowest among governance domains. Institutions identify IP/legal constraints as structural barriers. (see Mapping Charter Implementation in Deep Tech Context).

Mechanism

Dual expectations of openness and protection generate operational ambiguity without structured mediation.

Intervention Direction

Institutionalise IP literacy development and clear dissemination–protection sequencing guidelines.

7.4 Gap 4: Intersectoral Mobility and Reintegration Deficit

Evidence

High collaboration intensity coexists with significant administrative and procedural mobility barriers (see Mapping Charter Implementation in Deep Tech Context).

Mechanism

Multi-level governance complexity and absence of structured reintegration pathways increase transaction costs for cross-sector movement.

Intervention Direction

Develop formal mobility frameworks, reintegration models and simplified contractual templates.

7.5 Gap 5: Gendered Structural Exposure in Deep-Tech Domains

Evidence

Deep-tech domains remain structurally male-dominated at early career stages. Although majority of institutions report implementation of a Gender Equality Plan, persistent underrepresentation remains visible. Reported inclusion barriers are limited but (see Mapping Charter Implementation in Deep Tech Context).

Mechanism

Gender imbalance operates primarily through structural exposure rather than overt procedural discrimination. High workload intensity, project-based employment volatility and mobility expectations may create cumulative retention risks in infrastructure-intensive deep-tech environments.

Intervention Direction

Strengthen domain-sensitive retention mechanisms beyond formal equality compliance, including mentoring pipelines, monitoring of participation patterns in project-based contracts, and structural support for sustainable progression pathways.

8 IMPLICATIONS FOR DEEPTECH FRAMEWORK (BRIDGE TO TASK 2.2)

The structural gaps identified in Chapter 7 provide the evidence-based foundation for the development of the DeepTech Framework under Task 2.2. Each design principle presented below corresponds directly to one of the structural gaps derived from the CMO analysis and Charter mapping.

Rather than introducing operational instruments at this stage, this chapter formulates structural design orientations necessary to strengthen the operationalisation of the European Charter for Researchers in deep-tech ecosystems.

8.1 Principle 1: Funding-Resilient Career Structures

(Linked to Gap 1: Funding Architecture and Career Predictability)

Deep-tech research environments are characterised by grant-cycle dependency and infrastructure-intensive funding regimes. Career instability identified in Mapping Charter Implementation in Deep Tech Context is structurally mediated by funding architecture rather than institutional reluctance.

The DeepTech Framework should therefore promote mechanisms that:

- Mitigate discontinuity between project cycles
- Strengthen structured transition pathways between funding phases
- Enhance transparency of career sequencing beyond single grants
- Align funding models with long-term Charter commitments

The objective is to reduce structural precarity while preserving competitive research dynamics.

8.2 Principle 2: Evaluation Alignment with Innovation Practice

(Linked to Gap 2: Evaluation Misalignment)

Evaluation systems must reflect the hybrid nature of deep-tech research, where scientific excellence and innovation outputs coexist. The current partial dominance of publication-centred metrics constrains recognition of applied, intersectoral and translational contributions.

The DeepTech Framework should promote:

- Formal recognition of patents, prototypes and collaborative outputs
- Integration of innovation-oriented indicators into promotion criteria
- Alignment between institutional evaluation practices and innovation policy objectives

This principle emphasises recalibration of evaluation regimes rather than replacement of academic standards.

8.3 Principle 3: Structured Hybrid Knowledge Governance

(Linked to Gap 3: Knowledge Governance and IP Mediation)

Deep-tech research operates within hybrid regimes combining openness and intellectual property protection. Operational ambiguity arises when dissemination incentives and protection requirements are insufficiently coordinated.

The DeepTech Framework should support:

- Integration of intellectual property literacy within doctoral training
- Clear institutional guidelines for publication–protection sequencing
- Strengthened mediation capacity between research groups and technology transfer offices

The aim is to equip researchers to navigate hybrid governance environments without undermining research integrity or innovation potential.

8.4 Principle 4: Institutionalised Intersectoral Mobility Pathways

(Linked to Gap 4: Mobility Governance and Reintegration)

Although mobility is strategically endorsed across stakeholders, its operationalisation remains structurally fragile.

The DeepTech Framework should encourage:

- Formal reintegration pathways for researchers returning from industry
- Recognition of industrial experience within academic evaluation systems
- Standardised secondment and joint-supervision models
- Procedural simplification and clearer contractual templates

Mobility must be institutionally scaffolded rather than left to ad hoc arrangements.

8.5 Principle 5: Domain-Sensitive Inclusion and Talent Retention

(Linked to Gap 5: Gendered Structural Exposure)

Persistent gender imbalance in deep-tech domains reflects structural participation asymmetries rather than widespread procedural inequity.

The DeepTech Framework should therefore support:

- Targeted mentoring and leadership pipeline initiatives
- Monitoring of gender distribution in project-based contracts
- Integration of inclusion-sensitive indicators into evaluation systems
- Retention strategies adapted to infrastructure-intensive research contexts

Inclusion mechanisms must be tailored to technological fields with specific participation dynamics.

8.6 Strategic Integration Logic

The five design principles share a common orientation:

Charter implementation in deep-tech ecosystems requires structural alignment rather than additional normative articulation.

The empirical evidence demonstrates broad stakeholder convergence around Charter values. Implementation gaps arise from funding architecture, evaluation inertia, hybrid knowledge governance, mobility sequencing misalignment and structural inclusion dynamics.

Accordingly, the DeepTech Framework under Task 2.2 should prioritise:

- Structural mediation mechanisms
- Institutional alignment tools
- Competence development architectures
- Cross-sector integration pathways

rather than solely compliance-oriented instruments.

These principles form the conceptual bridge between the needs analysis conducted in Task 2.1 and the operational design phase of the DeepTech Framework.

9 CONCLUSIONS

This Analysis Report demonstrates that the European Charter for Researchers is broadly endorsed across stakeholder groups operating in deep-tech ecosystems. Normative alignment is strong. Transparent recruitment procedures are widely established. Collaboration between academia and industry is intensive. Institutional commitment to research integrity and fairness is explicit. Early-Career Researchers express strong identification with scientific values and openness to intersectoral engagement.

The central finding of this report is therefore not a deficit of commitment, but a deficit of structural alignment.

Across the triangulated dataset and qualitative evidence, implementation tensions emerge not from resistance to Charter principles, but from the interaction between those principles and the structural characteristics of deep-tech research environments.

Five recurrent systemic patterns were identified:

1. Project-based funding architectures condition career predictability and employment stability.
2. Evaluation regimes remain predominantly publication-centred, while innovation-oriented outputs are only partially embedded in formal recognition systems.
3. Hybrid knowledge governance generates operational tension between openness and intellectual property protection.
4. Intersectoral mobility is widely supported but procedurally complex and weakly institutionalised.
5. Gender imbalance reflects structural pipeline and retention dynamics in engineering-intensive domains.

These patterns are consistent across countries, institutional types and company sizes. While contextual variation exists, the dominant bottlenecks—funding volatility, evaluation inertia, governance ambiguity, administrative complexity and limited hybrid career structuring—are ecosystem-structural rather than actor-specific.

Collaboration willingness is not lacking. Project-level cooperation functions effectively. However, governance-level alignment remains incomplete. The evidence suggests that deep-tech ecosystems possess strong scientific capacity and cooperation intensity, but lack sufficiently stabilised structural mediation mechanisms.

The underlying dynamic is one of structural mediation:

- Funding models shape employment continuity.
- Evaluation frameworks shape behavioural incentives.
- Knowledge governance regimes shape dissemination practices.
- Administrative structures shape mobility feasibility.
- Participation asymmetries shape inclusion dynamics.

The Charter provides normative direction.

Deep-tech ecosystems require structural instruments.

Strengthening Charter implementation in deep-tech contexts therefore does not primarily require additional normative articulation. It requires:

- Alignment between funding architectures and sustainable career sequencing,
- Integration of translational and intersectoral contributions into evaluation systems,

- Structured reconciliation of publication and protection logics,
- Institutionalised reintegration mechanisms for mobility,
- Domain-sensitive retention and inclusion strategies.

Implementation gaps cluster in structurally sensitive domains rather than being evenly distributed across Charter principles. This concentration enables targeted intervention design.

The report thus provides a coherent, triangulated evidence base for Task 2.2. The DeepTech Framework should prioritise structural alignment mechanisms—funding resilience, evaluation recalibration, hybrid governance coordination, mobility sequencing and competence development—over compliance expansion alone.

In conclusion, the DeepTechSeeds analysis demonstrates that:

- Stakeholder convergence around Charter values is high.
- Structural misalignment is the principal implementation barrier.
- Ecosystem-level coordination is necessary to translate normative endorsement into operational coherence.

The pathway forward is clear:

From formal compliance to structural alignment.

From isolated measures to ecosystem coordination.

From normative commitment to operational architecture.

This report establishes the analytical foundation for that transition.

REFERENCES

[1] Council of the European Union. (2023). Council Recommendation of 18 December 2023 on a European framework to attract and retain research, innovation and entrepreneurial talents in Europe. http://data.europa.eu/eli/C/2023/1640/oj

[2] European Commission. (2023a). ERA monitoring 2023: 18 month review of the implementation of the ERA policy agenda ('EU level report'). Publications Office of the European Union. https://doi.org/10.2777/499744

[3] European Commission (2024). European Innovation Scoreboard 2024. Publications Office of the European Union. https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en

[4] European Commission. (2023b). Leading the new wave of deep tech innovation: Projects under the European innovation ecosystems work programme in support of the new European innovation agenda. Publications Office. https://doi.org/10.2777/111976

[5] European Commission (2021). She Figures 2021: Gender in Research and Innovation. Publications Office of the European Union. https://op.europa.eu/en/publication-detail/-/publication/9540ffa1-4472-11ec-89db-01aa75ed71a1

[6] European Innovation Council and SMEs Executive Agency. (2025). Scaling Deep Tech in Europe: European Innovation Council Impact Report 2025. Publications Office. https://doi.org/10.2826/1391424

[7] Heitor, M., Ratcliff, S., Björnmalm, M., Bondarouk, T., & Klein Ikkink, V. (2024). Research careers: A critical choice for Europe. CESAER. https://doi.org/10.5281/ZENODO.14357267

[8] Kent, B. A., Holman, C., Amoako, E., Antonietti, A., Azam, J. M., Ballhausen, H., Bediako, Y., Belasen, A. M., Carneiro, C. F. D., Chen, Y.-C., Compeer, E. B., Connor, C. A. C., Crüwell, S., Debat, H., Dorris, E., Ebrahimi, H., Erlich, J. C., Fernández-Chiappe, F., Fischer, F., … Weissgerber, T. L. (2022). Recommendations for empowering early career researchers to improve research culture and practice. PLOS Biology, 20(7), e3001680. https://doi.org/10.1371/journal.pbio.3001680

[9] Marijan, D., & Sen, S. (2022). Industry–Academia Research Collaboration and Knowledge Co-creation: Patterns and Anti-patterns. ACM Transactions on Software Engineering and Methodology, 31(3), 1–52. https://doi.org/10.1145/3494519

[10] OECD. (2023). Promoting diverse career pathways for doctoral and postdoctoral researchers (OECD Science, Technology and Industry Policy Papers No. 158; OECD Science, Technology and Industry Policy Papers, Roč. 158). OECD. https://doi.org/10.1787/dc21227a-en

[11] OECD. (2025). OECD Science, Technology and Innovation Outlook 2025: Policy Insights to Navigate Today's Shifting Landscape. OECD Publishing. https://doi.org/10.1787/5fe57b90-en

[12] Science Europe. (2023). 2022 Annual Report: Research at the Heart of Europe's Ambition (H. Zeghiche, V. Garoia, L. Borrell-Damián, I. Groeneveld, & J. Moynat, Ed.). Science Europe. https://doi.org/10.5281/ZENODO.8058597

[13] Science Europe. (2024). 2023 Annual Report: From Ambition to Action – Fostering Research Excellence in Europe. Science Europe. https://scienceeurope.org/our-resources/from-ambition-to-action-fostering-research-excellence-in-europe-2023-annual-report/

[14] Science Europe. (2025). 2024 Annual Report: Advancing Excellence, Realising Impact. Science Europe. https://scienceeurope.org/media/rk1da2nk/science-europe-annual-report-2024.pdf

[15] Schuh, G., Latz, T., Hedemann, M., & Reufsteck, T. F. (2023). Accelerating Deep Tech Innovations: A case study approach for characterizing actors along the national technology transfer process. Fraunhofer Institute for Production Technology IPT. https://doi.org/10.24406/PUBLICA-468

[16] Greinert, F., Goorney, S., Hilfert-Rüppell, D., Ubben, M. S., & Müller, R. (2025). Extending the European Competence Framework for Quantum Technologies: New proficiency triangle and qualification profiles. EPJ Quantum Technology, 12(1), 1. https://doi.org/10.1140/epjqt/s40507-024-00302-5

ANNEXES

The following annexes provide methodological transparency and supporting documentation for Deliverable D2.1.

ANNEX I – SURVEY INSTRUMENTS

On the next pages the used survey instruments are provided.

Supporting the
European Research Area

Annex I.A – Survey Instrument (Early Career Researchers)

The DeepTechSeeds project *has received funding from the European Union's Horizon Europe research and innovation programme, under the Reforming and Enhancing the European R&I System strand (HORIZON-WIDERA-2024-ERA-02-03),* ***Grant Agreement No.*** *101216535.*

DeepTechSeeds: Early Carrier Researchers Talent Voice

This short survey (max. 10 minutes) is part of the DeepTechSeeds (Horizon Europe) project. Its purpose is to understand the experiences, needs, and challenges of Early-Career Researchers (ECRs) working in deep-tech fields — including skills development, career opportunities, mobility, and working conditions.

Who should respond: doctoral candidates, postdoctoral researchers, junior researchers, and other early-stage professionals involved in deep-tech research.

The survey is anonymous. You may voluntarily leave your contact details at the end if you wish to stay involved.

SECTION A. Background & Research Profile

In this section, we ask about your research domain, current position, and level of experience. This information helps us better understand the profile of Early-Career Researchers participating in the survey and interpret the results in the context of different career stages and deep-tech fields.

1. Which deep-tech domain best describes your research?

- ○ Artificial Intelligence / Machine Learning
- ○ Robotics / Autonomous Systems
- ○ 5G/6G Telecommunications
- ○ Quantum Technologies
- ○ Advanced Materials / Nanotechnology
- ○ Other:

2. What is your current position?

- ○ PhD student
- ○ Postdoctoral researcher
- ○ Junior researcher
- ○ Early-career engineer
- ○ Other:

3. What is your gender?

- ○ Female
- ○ Male
- ○ Non-binary
- ○ Prefer not to say

Funded by
the European Union

4. Country of your institution:

- ▢ Austria
- ▢ Belgium
- ▢ Bulgaria
- ▢ Croatia
- ▢ Cyprus
- ▢ Czech Republic
- ▢ Denmark
- ▢ Estonia
- ▢ Finland
- ▢ France
- ▢ Germany
- ▢ Greece
- ▢ Hungary
- ▢ Ireland
- ▢ Italy
- ▢ Latvia
- ▢ Lithuania
- ▢ Luxembourg
- ▢ Malta
- ▢ Netherlands
- ▢ Poland
- ▢ Portugal
- ▢ Romania
- ▢ Slovakia
- ▢ Slovenia
- ▢ Spain
- ▢ Sweden
- ▢ Other:

5. Have you previously worked in a deep-tech company?

- ○ Yes
- ○ No

SECTION B. Research Environment & Infrastructure

This section asks about your access to specialised deep-tech infrastructure and whether you collaborate with industry or tech organisations. This helps us identify bottlenecks in your research environment and understand what improvements are needed to support your work and development as an Early-Career Researcher.

6. **How would you rate your institution's access to specialised deep-tech infrastructure in your research domain (e.g., labs, HPC, fabrication facilities)?**

	1	2	3	4	5	
Not available	○	○	○	○	○	**Excellent**

7. **Have you collaborated with industry or tech organisations as part of your research?**
   - ○ Yes, regularly
   - ○ Yes, occasionally
   - ○ Rarely
   - ○ Never

SECTION C. Recruitment, Contracts & Career Pathways

Transparent recruitment and clear career progression are core principles of the European Charter for Researchers. Your input helps identify structural problems and supports the development of better frameworks for stability, fairness, and mobility.

8. **Was your recruitment process transparent and merit-based?** *(By transparent and merit-based we mean that the selection process was open, clearly communicated, and based on your qualifications, experience, and competencies – for example: publicly advertised position, clear selection criteria, structured interviews, and feedback on the decision.)*

	1	2	3	4	5	
Definitely not	○	○	○	○	○	**Definitely yes**

9. **Do you understand the available career pathways in deep tech at your institution?** *(By career pathways we mean whether you are aware of and clearly understand what career options exist for you in your institution and the deep-tech field – for example progression from PhD to postdoc, junior/senior researcher, group leader, principal investigator, or transition to industry roles. This also includes clarity about promotion criteria, required competencies, evaluation processes and long-term career prospects.)*

	1	2	3	4	5	
Definitely not	○	○	○	○	○	**Definitely yes**

10. **What are the main barriers to your career development?** (Select all that apply)
    - ☐ It's unclear or uncertain how my career can develop
    - ☐ My skills and achievements are not sufficiently recognised
    - ☐ I don't have enough opportunities to connect, collaborate, or grow professionally
    - ☐ I lack mentoring or clear guidance
    - ☐ There is too much pressure and uncertainty about job stability

Funded by
the European Union

- ▢ I have limited chances to move internationally or between sectors
- ▢ I experience discrimination or unfair treatment
- ▢ Other:

SECTION D. Skills, Training & Competence Gaps

This section examines the importance of specific deep-tech skills in your work, your training needs (both technical and transversal), and how well current training opportunities at your institution support your development and reflect industry requirements.

11. To what extent do you need further development of the following transversal skills to support your career in deep tech?

	No need	Low need	Moderate need	High need	Very high need
Communication & public engagement	○	○	○	○	○
Time management and self-organisation	○	○	○	○	○
Leadership skills, teamwork and collaboration	○	○	○	○	○
Professional skills for research careers (intelectual property, entrepreneurship, grant writing, networking, project management, innovation)	○	○	○	○	○

12. How adequate is your institution's training offer?

	1	2	3	4	5	
Very poor	○	○	○	○	○	**Excellent**

SECTION E. Mobility & Cross-Sector Collaboration

One of the main goals is to strengthen mobility between academia, industry, and public-sector R&D. Your answers help us understand what limits such mobility and which opportunities would be most beneficial.

13. What factors prevent you from moving between academia and industry? (Select all that apply)

- ▢ I don't know enough about job or project opportunities outside my current sector
- ▢ It's unclear how to move between academia and industry
- ▢ The working style and expectations are very different
- ▢ Experience from the other sector is not fully valued or recognised
- ▢ Other:

14. Would you participate in an industry placement or startup internship? (Select all that apply)

- ○ Yes, definitely
- ○ Yes, maybe
- ○ Not sure
- ○ No

Funded by the European Union

SECTION F. Open Science, Ethics & Responsible Innovation

Deep-tech fields come with specific ethical, safety, and regulatory considerations. Understanding your awareness and training needs helps ensure responsible and future-proof innovation practices.

15. Have you received training in the following areas? (Select all that apply)

- ☐ Open Science (covers open access, data sharing and FAIR principles)
- ☐ Research integrity (covers ethical research conduct, including plagiarism, data manipulation and authorship rules.)
- ☐ GDPR and data protection
- ☐ Intellectual property and patent regulations
- ☐ AI ethics and societal impacts
- ☐ Environmental sustainability and compliance
- ☐ No, I have not received training in these areas

16. How confident do you feel in your understanding and ability to apply the following topics in your deep-tech field?

	Very low	Low	Moderate	High	Very high
Open science	○	○	○	○	○
Research integrity	○	○	○	○	○
GDPR and data protection	○	○	○	○	○
IP and patent regulations	○	○	○	○	○
AI ethics and societal impacts	○	○	○	○	○
Environmental sustainability and compliance	○	○	○	○	○

SECTION G. Diversity, Inclusion & Research Culture

Innovation benefits from diverse perspectives. Your feedback helps us identify potential cultural or structural issues and shape recommendations for fair and inclusive environments.

17. Did you observe any of the following inclusion-related barriers in your research environment? (Select all that apply)

- ☐ Gender bias or discrimination
- ☐ Limited inclusivity for international researchers, language barriers affecting participation
- ☐ Lack of support for researchers with disabilities
- ☐ Harassment or inappropriate behaviour
- ☐ Lack of inclusive institutional policies
- ☐ Other:

Funded by the European Union

SECTION H. Future Aspirations & Recommendations

Your aspirations guide our development of the DeepTech Framework and talent ecosystem. Understanding what you want from a deep-tech career helps us recommend meaningful changes.

18. What is your preferred long-term deep-tech career path?

- ○ Academic research
- ○ Industrial R&D
- ○ Startup founder / entrepreneurship
- ○ Consulting / technology strategy
- ○ Other:

19. To what extent would the following changes improve deep-tech career development at your institution?

	Would not improve	Would improve slightly	Would improve moderately	Would improve significantly	Would improve very significantly
Clear & structured career development	○	○	○	○	○
Increased funding for early-career researchers	○	○	○	○	○
Stronger mentoring & supervision	○	○	○	○	○
Stronger industry collaboration	○	○	○	○	○
More international mobility opportunities	○	○	○	○	○

If you would like to stay connected, contribute more actively to the development of the deep-tech talent ecosystem, or be informed about future collaboration and career opportunities, ***you may voluntarily leave your contact details at the end of this questionnaire.***

Funded by
the European Union

Annex I.B – Survey Instrument (Academia, RPOs)

The DeepTechSeeds project *has received funding from the European Union's Horizon Europe research and innovation programme, under the Reforming and Enhancing the European R&I System strand (HORIZON-WIDERA-2024-ERA-02-03),* ***Grant Agreement No.*** *101216535.*

DeepTechSeeds Institutional Pulse – Research institutions and University Survey

This short survey is part of the DeepTechSeeds (Horizon Europe) project. Its purpose is to understand how institutions support Early-Career Researchers (ECRs) in deep-tech fields and what they need to strengthen researcher careers and mobility.
Who should respond: HR managers, research office staff, and institutional leaders involved in researcher development.
Completing this survey will take no more than 10 minutes. Thank you very much for your time and contribution.
The survey is anonymous. You may leave your contact details at the end if you wish to stay involved.

SECTION A. Organizational Profile

These questions help us understand the type of research organization, its size, and its deep-tech involvement. This context ensures that recommendations are tailored to your institutional realities.

1. What type of research-performing organization are you?

○ University
○ Public research center
○ Private research organization

2. How many researchers do you employ (approx.)?

○ Fewer than 50
○ 50–199
○ 200–499
○ 500–999
○ 1000+

3. Country of your main institution:

☐ Austria
☐ Belgium
☐ Bulgaria
☐ Croatia
☐ Cyprus
☐ Czech Republic
☐ Denmark
☐ Estonia
☐ Finland

Funded by the European Union

- ☐ France
- ☐ Germany
- ☐ Greece
- ☐ Hungary
- ☐ Ireland
- ☐ Italy
- ☐ Latvia
- ☐ Lithuania
- ☐ Luxembourg
- ☐ Malta
- ☐ Netherlands
- ☐ Poland
- ☐ Portugal
- ☐ Romania
- ☐ Slovakia
- ☐ Slovenia
- ☐ Spain
- ☐ Sweden
- ☐ Other:

4. Does your organization work in deep-tech areas (AI, robotics, quantum, advanced materials, 5G/6G telecom)?

- ○ Yes, primarily
- ○ Yes, partially
- ○ Minimally
- ○ Not currently

SECTION B. Charter Implementation & HR Excellence

Understanding your experience with the Charter and HR Award helps identify where support is most needed to improve researcher working conditions.

5. Does your institution hold the HR Excellence in Research Award?

- ○ Yes
- ○ In progress, organisation committed to the European Charter for Researchers
- ○ No, but considering it
- ○ No and NOT considering it

6. Which principles of Charter for Researchers are most challenging to implement?

- ☐ Recruitment & selection
- ☐ Working conditions
- ☐ Career development
- ☐ Ethics & integrity
- ☐ Gender equality
- ☐ I do not have sufficient information to answer this question

Funded by the European Union

7. What are the main barriers to implementing the Charter? (select all that apply)

- ▢ Lack of staff capacity
- ▢ Administrative constraints
- ▢ Insufficient funding
- ▢ Limited institutional awareness
- ▢ Cultural resistance
- ▢ I do not have sufficient information to answer this question
- ▢ Other:

SECTION C. Working Conditions & Research Culture

These questions help assess the environment researchers work in, identifying structural issues and opportunities for improvement.

8. To what extent are the following support structures for Early-Career Researchers established and functioning in your institution?

	Not in place	Weakly developed	Moderately developed	Well developed	Very well developed
Clear guidelines for researcher roles and evaluation	○	○	○	○	○
Mentoring programmes	○	○	○	○	○
Career development services for deep-tech ECRs	○	○	○	○	○
HR guidance and individual support	○	○	○	○	○
Training for supervisors	○	○	○	○	○
Structured onboarding of ECRs	○	○	○	○	○

SECTION D. Training & Skills Development

This section helps us understand gaps in institutional training offerings, especially in deep-tech skills and transversal competencies.

9. What training is needed in your institution in the following areas for early career researchers (ECRs)? (Select all that apply)

- ▢ Deep-tech technical skills
- ▢ Project & time management
- ▢ Responsible research & open science
- ▢ Technology transfer & IP
- ▢ Communication, teamwork & leadership
- ▢ Industry-oriented practical skills
- ▢ Other:

Funded by
the European Union

SECTION E. Collaboration & Mobility

Cross-sector mobility is crucial in deep tech. Your insights help us identify obstacles and opportunities for academic–industry cooperation.

10. How often does your organization collaborate with industry?

- ○ Regularly – as part of ongoing strategic partnerships (at least monthly)
- ○ Frequently – through multiple projects or activities (several times per year)
- ○ Occasionally – ad-hoc collaborations (once or twice per year)
- ○ Rarely – only in exceptional cases (less than once per year)
- ○ Never – no collaboration with industry so far

11. What factors limit mobility between academia and industry at your institution? (Select all that apply)

- ▢ IP, legal concerns and funding constraints
- ▢ Lack of industry contacts
- ▢ Differences in working conditions and career structures
- ▢ Limited institutional support for mobility
- ▢ Administrative & bureaucratic barriers
- ▢ Other:

SECTION F. Gender Equality & Inclusion

Deep-tech fields often face diversity challenges. Understanding the situation in your institution helps shape effective equality measures.

12. Do you implement a Gender Equality Plan?

- ○ Yes
- ○ In progress
- ○ No, but considenig it
- ○ No and NOT consicering it

13. To what extent do the following inclusion challenges persist in your institution?

	Not serious	Slightly serious	Moderately serious	Very serious	Extremely serious
Gender imbalance	○	○	○	○	○
Diversity in leadership	○	○	○	○	○
Support for international researchers	○	○	○	○	○
Recruitment bias	○	○	○	○	○
Accessibility challenges	○	○	○	○	○

SECTION G. Strategic Needs & Future Priorities

Your answers can help guide recommendations and policy actions to support institutional change in deep-tech environments.

Funded by
the European Union

14. To what extent would the following measures help your institution improve the implementation of the European Charter for Researchers?

	Would not help	Would help slightly	Would help moderately	Would help significantly	Would help very significantly
Increased funding for HR development	○	○	○	○	○
Strengthened HR and research support capacity	○	○	○	○	○
Better training and professional development programmes	○	○	○	○	○
Improved institutional digital tools & processes	○	○	○	○	○
Stronger leadership commitment & clearer national/EU guidance	○	○	○	○	○

If your organisation would like to stay connected, contribute more actively to the DeepTechSeeds ecosystem or explore future cooperation opportunities with industry and research partners, ***you may voluntarily provide your contact details at the end of this questionnaire.***

Funded by
the European Union

Annex I.C – Survey Instrument (Industry)

The DeepTechSeeds project *has received funding from the European Union's Horizon Europe research and innovation programme, under the Reforming and Enhancing the European R&I System strand (HORIZON-WIDERA-2024-ERA-02-03),* ***Grant Agreement No.*** *101216535.*

Future Skills in Deep Tech: Industry Voice

This short survey is conducted within the DeepTechSeeds project. Its purpose is to understand the needs, challenges, and expectations of companies working with deep-tech talent and collaborating with researchers.
Who should respond: company representatives in deep-tech sectors engaged in workforce development, R&D, and cooperation with academia.
Completing this survey will take no more than 10 minutes. Thank you very much for your time and contribution.
The questionnaire is anonymous. If you wish to explore future collaboration with the DeepTechSeeds ecosystem, you may voluntarily leave your contact details at the end.

SECTION A. Company Profile

These questions help map your company's size, sector, and involvement in deep-tech fields to tailor the ecosystem to your needs.

1. **What is the size of your company?**
   - ○ Micro enterprise (1–9 employees)
   - ○ Small enterprise (10–49 employees)
   - ○ Medium enterprise (50–249 employees)
   - ○ Large enterprise (250+ employees)
2. **How many researchers or research-related employees do you have?**
   - ○ 0–5
   - ○ 6–20
   - ○ 21–50
   - ○ 51–200
   - ○ 200+
3. **In which EU countries does your company actively operate? Please indicate countries where your company has operational activities, such as offices, production sites, R&D centres, or regular business operations.)** (Select all that apply)
   - ☐ Austria
   - ☐ Belgium
   - ☐ Bulgaria
   - ☐ Croatia
   - ☐ Cyprus
   - ☐ Czech Republic
   - ☐ Denmark
   - ☐ Estonia
   - ☐ Finland

- ☐ France
- ☐ Germany
- ☐ Greece
- ☐ Hungary
- ☐ Ireland
- ☐ Italy
- ☐ Latvia
- ☐ Lithuania
- ☐ Luxembourg
- ☐ Malta
- ☐ Netherlands
- ☐ Poland
- ☐ Portugal
- ☐ Romania
- ☐ Slovakia
- ☐ Slovenia
- ☐ Spain
- ☐ Sweden
- ☐ Other:

SECTION B. Skills Needs & Workforce Challenges

Understanding skill gaps and recruitment challenges helps us align training programs and mobility schemes with industry needs.

4. Which deep-tech domains does your company operate in? (select all that apply)

- ☐ AI / ML
- ☐ Robotics
- ☐ Telecom (5G/6G)
- ☐ Advanced materials
- ☐ Quantum Computing
- ☐ Other:

5. To what extent are the following transversal skills lacking among deep-tech candidates and Early-Career Researchers from your perspective?

	Not lacking	Slightly lacking	Moderately lacking	Significantly lacking	Critically lacking
Communication & Teamwork	○	○	○	○	○
Project & Time management	○	○	○	○	○
Problem-solving & Innovation and creativity	○	○	○	○	○
Understanding of IP and regulations	○	○	○	○	○

Funded by
the European Union

Business and commercial awarenes	○	○	○	○	○

SECTION C. Collaboration with Academia

Your input helps us improve academic–industry collaboration models and address barriers that hinder effective partnerships.

6. **How would you describe your company's overall level of collaboration with universities or research institutes?** (select all that apply)
   - ▢ Very active and strategic
   - ▢ Occasional and project-based
   - ▢ Limited and informal
   - ▢ No collaboration yet, but interested
   - ▢ No collaboration and no current interest
   - ▢ Other:

7. **To what extent do the following factors limit effective collaboration between your company and academic or research institutions?**

	Not a barrier	Minor barrier	Moderate barrier	Significant barrier	Major barrier
Administrative complexity and bureaucracy	○	○	○	○	○
Slow academic timelines	○	○	○	○	○
IP and legal issues & funding constraints	○	○	○	○	○
Misalignment of expectations & Skill mismatch	○	○	○	○	○
Limited flexibility of academic structures	○	○	○	○	○

SECTION D. Mobility, Internships & Talent Pipelines

Mobility opportunities help companies access talent while giving ECRs real-world experience. These questions help us refine mobility design.

8. **Are you interested in hosting internships or placements for Early Career Researchers?**
   - ○ Yes
   - ○ Maybe
   - ○ Not currently
   - ○ No

9. **What measures make it easier for your company to host Early-Career Researchers?** (Select all that apply)
   - ▢ Financial support for hosting Early-Career Researchers

- ▢ Clear and simplified procedures (legal, IP, administrative)
- ▢ Dedicated coordination and mentoring support from universities
- ▢ Shorter and more flexible placement schemes
- ▢ Better matching between company needs and Early Career Researchers profiles
- ▢ Other:

SECTION E. Working Conditions & Career Pathways

This section helps identify what career opportunities exist in industry and how ECRs can better transition into them.

10. What career pathways do you offer for researchers? (Select all that apply)

- ▢ R&D engineer
- ▢ Scientist/researcher
- ▢ Innovation manager
- ▢ Product developer
- ▢ Data scientist
- ▢ Other:

11. How well developed are the following onboarding and training practices for new researchers in your company?

	Not provided	Poorly developed	Moderately developed	Well developed	Very well developed
Technical training related to deep-tech roles & Training in company processes and tools	○	○	○	○	○
Soft-skills training & Introduction to innovation and R&D workflows	○	○	○	○	○
Safety & regulatory training	○	○	○	○	○
Structured mentoring for new researchers	○	○	○	○	○
Formal onboarding programme	○	○	○	○	○

SECTION F. Open Innovation & Collaboration Models

Deep-tech innovation often depends on open collaboration frameworks. Your answers help shape challenge-based programmes.

12. Do you participate in open innovation challenges? *(Open innovation challenges refer to collaborative initiatives where companies work together with external partners such as universities, startups, researchers or public organisations to solve specific technological or market problems. These may include hackathons, joint R&D calls, innovation contests, pilot testing programmes, challenge-based funding schemes or co-creation platforms where ideas, data or technologies are shared to develop new solutions.)*

Funded by the European Union

- ○ Yes
- ○ Occasionally
- ○ Not yet but interested
- ○ No

13. What types of innovation challenges would be valuable for your company? (Select all that apply)

- ▢ Technical challenges (solving specific technological problems)
- ▢ Market-driven challenges (focused on customer or market needs)
- ▢ Joint research & development initiatives with academic partners
- ▢ Pilot testing and demonstration programmes
- ▢ Open innovation calls with external partners
- ▢ Other:

SECTION G. Expectations & Future Needs

Understanding your expectations helps align the talent ecosystem with industry requirements.

14. What support would help your company attract deep-tech talents? (Select all that apply)

- ▢ Better collaboration & matching tools
- ▢ Better training & placement programmes
- ▢ Access to academia (labs, expertise)
- ▢ International recruitment support
- ▢ Visibility of opportunities
- ▢ Other:

Name of your company and e-mail contact *(optional. providing your company name is voluntary, however we kindly encourage you to share it if you are interested in becoming more actively involved in the deep-tech talent ecosystem. This may open opportunities for tailored support, visibility, and collaboration that can benefit your company in attracting skilled deep-tech professionals and strengthening your position within the innovation landscape.)*

Funded by
the European Union

ANNEX II – FOCUS GROUP GUIDES

On the next pages the used focus groups guides are provided.

Annex II.A –Focus Group Guide (ECRs)

Purpose

This analytical focus group explores how the principles of the European Charter for Researchers are experienced, interpreted and enacted in practice by early-career researchers (ECRs) and PhD candidates within deep tech research environments.

The discussion aims to:
- contextualise and deepen interpretation of survey findings within the DeepTechSeeds needs analysis,
- explore lived experiences underlying identified priority needs,
- understand mechanisms shaping early research careers in deep tech contexts.

The focus group is analytical rather than solution-oriented. Participants are encouraged to reflect on structural patterns, institutional practices and shared experiences rather than proposing specific solutions or good practices.

Methodological Approach

This focus group follows a semi-structured analytical design informed by a realist evaluation perspective (context–mechanism–outcome framework). The discussion aims to identify how institutional contexts and structural mechanisms influence early research career experiences in deep tech environments.
Participant perspectives provide experiential insight complementing institutional-level focus groups within the triangulated research design.

Participants

- PhD candidates and early-career researchers (postdoctoral level),
- Active in deep tech domains (e.g. AI, robotics, advanced materials, quantum, 5G/6G, photonics),
- Experience with project-based and/or industry-linked research.

Group size: 6–8 participants
Format: Online focus group
Duration: 90 minutes
Moderation: Semi-structured discussion
Reporting: Fully anonymised

Moderator Guidance

- Encourage participants to reflect on shared patterns rather than only individual cases.
- Invite comparison between formal institutional structures and everyday experiences.
- Balance participation across participants.
- Avoid turning discussion into solution brainstorming.
- If time becomes limited, prioritise Themes 1–3 as core analytical areas.

Funded by
the European Union

Time Structure

0–10 min	Welcome, ethical framing, introductions, warm-up
10–25 min	Theme 1: Career paths & recognition
25–40 min	Theme 2: Employment & project-based work
40–55 min	Theme 3: Supervision & mentoring
55–70 min	Theme 4: Cross-sector mobility
70–85 min	Theme 5: Inclusion and Research Culture
85–90 min	Closing reflection

Opening Question (Grounding)

When thinking about your early research career in deep tech — what aspect of the system or environment influences your experience the most?

Thematic Structure and Guiding Questions

Theme 1 – Career Paths and Recognition of Merit

Analytical focus: How early-career researchers perceive career development, progression and recognition within deep tech research environments.

Guidance for participants: Please reflect on your career trajectory so far (PhD, postdoc, researcher role, contract type) and how your work is evaluated or recognised.

Guiding questions:

1. What is your study, research and work history?
2. What types of scientific and research outputs are appreciated in your setting?
3. Is there a difference between what you do and what is appreciated?

Theme 2 – Employment Conditions and Project-Based Research

Analytical focus: How employment models and project-based funding influence stability, predictability and career decision-making.

Guidance for participants: Focus on your current employment situation and perceived future stability.

Guiding questions:

1. Do you have any idea what your career will look like in the next 1-3 years?
2. How strongly is your position tied to projects/grants?
3. How satisfied are you with the opportunities for future career growth in your organisation?

Theme 3 – Supervision and Mentoring

Analytical focus: Formal and informal support structures shaping career development and guidance.

Guidance for participants: Think beyond formal supervision and reflect on broader support networks.

Funded by
the European Union

Guiding questions:

1. Who supports you besides your formal supervisor?
2. What other support is there? E.g. advice on collaborations with industry, intellectual property, careers outside the academy sector?

Theme 4 – Cross-Sector Mobility

Analytical focus: Experiences, perceptions and barriers related to movement between academia and non-academic sectors.

Guidance for participants: You may reflect on direct experience or perceived barriers.

Guiding questions:

1. Is it possible to combine work in academy and industry sector in your institution?
2. Are you motivated to work in both academic and private sectors?
3. Does your institution have support set up for gaining experience outside the academic sector?

Theme 5 – Inclusion and Research Culture

Analytical focus: Perceptions of fairness, inclusion and everyday research culture within deep tech environments.

Guidance for participants: Reflect on everyday practices rather than formal policies only.

Guiding questions:

1. Describe the research culture in your university setting in relation to collaboration, openness and support for professional development?
2. Which of these helps you the most to succeed?
3. Are resources and opportunities equitably and fairly available in your institution?

Closing Reflection

„From your perspective which structural or systemic factors most strongly influence whether early research careers in deep tech feel attractive, viable and sustainable?"

Funded by
the European Union

Supporting the European Research Area

Annex II.B Focus Group Guide (Academia, RPOs)

Purpose

This analytical focus group explores how research-performing organisations (RPOs) operationalise the implementation of the European Charter for Researchers within deep tech research environments. The discussion focuses on institutional mechanisms, structural constraints and perceived outcomes shaping early research careers, particularly for PhD candidates and early-career researchers (ECRs).
The focus group is analytical rather than evaluative or solution-oriented. Participants are invited to reflect primarily on institutional structures, norms and practices rather than individual experiences.

The discussion focuses on:

- how early research careers are institutionally framed, recognised and evaluated in deep tech environments,
- how employment models and project-based funding shape career continuity, predictability and precarity,
- how supervision, mentoring and institutional support structures are organised and governed,
- how cross-sector mobility and collaboration with industry are institutionally enabled or constrained,
- how inclusion, gender equality and informal research culture influence access to opportunities and career sustainability.

Methodological Approach

This focus group follows a semi-structured analytical design guided by a realist evaluation perspective (context–mechanism–outcome framework). The discussion aims to identify institutional mechanisms and contextual factors influencing the implementation of the European Charter for Researchers within deep tech research settings.
Participants are encouraged to discuss institutional practices, structural conditions and systemic patterns rather than personal case narratives.

Participants

- Academic staff and supervisors
- Heads of research groups or laboratories
- Department or faculty leadership
- Research management, HR or research support staff

Group size: 6–8 participants
Format: Online focus group
Duration: 90 minutes
Reporting: Fully anonymised

Moderator Guidance

- Encourage discussion from an institutional rather than individual perspective.
- Ask participants to distinguish between formal policies and lived practices.
- Invite concrete examples of mechanisms or institutional arrangements.
- Ensure balanced participation across roles.
- If time becomes limited, prioritise Themes 1–3 as core analytical areas.

Funded by the European Union

Supporting the European Research Area

Time Structure

0–10 min	Welcome, ethical framing, introductions, warm-up
10–25 min	Theme 1: Institutional Context and Career Paths
25–40 min	Theme 2: Employment Models and Project-Based Funding
40–55 min	Theme 3: Supervision, Mentoring and Institutional Support
55–70 min	Theme 4: Cross-Sector Mobility and External Collaboration
70–85 min	Theme 5: Inclusion, Equality and Research Culture
85–90 min	Closing reflection

Opening Question (Grounding)

When thinking about early research careers in deep tech at your institution — what is the first structural or institutional feature that comes to your mind?

Thematic Structure and Guiding Questions

Theme 1 – Institutional Context and Career Paths

Analytical focus: How early research careers are formally framed, legitimised and valued at institutional level, particularly in deep tech contexts where non-linear or hybrid career trajectories are common.

Guiding questions:

1. What is your study, research and work history?
2. What types of scientific and research outputs are appreciated in your setting?
3. Is there a difference between what you do and what is appreciated?

Theme 2 – Employment Models and Project-Based Funding

Analytical focus: How funding models and employment arrangements structure opportunities, risks and constraints for early research careers.

Guiding questions:

1. How are PhD candidates and ECRs typically employed or contracted at your institution?
2. To what extent are early research positions dependent on external project funding?
3. Are there institutional mechanisms that mitigate employment precarity for ECRs?

Theme 3 – Supervision, Mentoring and Institutional Support

Analytical focus: The balance between individual responsibility and institutional responsibility for supervision and career development.

Guiding questions:

1. How is supervision of PhD candidates and ECRs formally organised at your institution?
2. How is the quality of supervision monitored or supported institutionally?
3. Beyond scientific supervision, what other forms of support are available to ECRs?
4. To what extent is your institution able to internally organise and offer deep-tech–specific courses or training for PhD candidates and ECRs?

Funded by the European Union

Theme 4 – Cross-Sector Mobility and External Collaboration

Analytical focus: Institutional framing and valuation of mobility between academia and non-academic sectors.

Guiding questions:

1. How is mobility between academia and industry (or other sectors) perceived at your institution?
2. Are periods spent outside academia formally recognised in career evaluation or progression?
3. What organisational or administrative barriers limit cross-sector mobility for ECRs, especially those engaged in deep tech research?

Theme 5 – Inclusion, Equality and Research Culture

Analytical focus: Interaction between formal equality policies and informal institutional culture.

Guiding questions:

1. How does your institution address inclusion and gender equality in deep tech fields?
2. Are there observable differences in access to opportunities among ECRs?
3. How open is the institutional culture to discussing these issues?

Closing Reflection

„From an institutional perspective which structural mechanisms or conditions most strongly influence whether early research careers in deep tech are perceived as attractive, viable and sustainable?“

Annex II.C Focus Group Guide (Industry)

Purpose

This analytical focus group explores how industry employers in deep tech perceive early-career researchers (ECRs) and PhD candidates, and how organisational practices, expectations and collaboration models influence the implementation of European Charter for Researchers principles beyond academia.

The discussion focuses on:

- expectations towards ECR skills and profiles,
- recognition and translation of research outputs and experience,
- collaboration models and supervision interfaces with academia,
- barriers and enablers of cross-sector mobility,
- inclusion, diversity and organisational culture within deep tech companies.

The focus group is analytical rather than evaluative and does not aim to define solutions or best practices. Participants are encouraged to reflect on organisational patterns and systemic factors rather than individual cases.

Methodological Approach

This focus group follows a semi-structured analytical design informed by a realist evaluation perspective (context–mechanism–outcome framework). The discussion aims to explore how organisational contexts and industry-specific mechanisms shape expectations, collaboration and career transitions for early research careers.

Industry perspectives provide a complementary lens within the triangulated research design, alongside institutional and early-career researcher focus groups.

Participants

Industry employers active in deep tech domains, such as:

- R&D managers and team leaders
- CTOs or technical directors
- Innovation managers
- HR managers involved in researcher recruitment
- Founders or senior staff in deep tech SMEs and startups

Participants should have direct experience with hiring, supervising or collaborating with PhD candidates or early-career researchers.

Group size:	6–8 participants
Format:	Online focus group
Duration:	90 minutes
Reporting:	Fully anonymised, company-neutral

Funded by
the European Union

Supporting the European Research Area

Moderator Guidance

- Encourage reflection on organisational practices rather than individual anecdotes.
- Invite participants to compare expectations with actual collaboration experiences.
- Focus discussion on structural patterns and systemic dynamics.
- Avoid solution-oriented discussions.
- If time becomes limited, prioritise Themes 1–3 as core analytical areas.

Time Structure

0–10 min	Welcome, ethical framing, introductions, warm-up
10–25 min	Theme 1: Expectations Towards Early-Career Researchers
25–40 min	Theme 2: Employment Recognition of Skills and Research Outputs
40–55 min	Theme 3: Collaboration with Academia and Supervision Interfaces
55–70 min	Theme 4: Cross-Sector Mobility and Employment Transitions
70–85 min	Theme 5: Inclusion, Diversity and Organisational Culture
85–90 min	Closing reflection

Opening Question (Grounding)

When thinking about early-career researchers entering deep tech industry — what organisational factor most strongly shapes their integration or success?

Thematic Structure and Guiding Questions

Theme 1 – Expectations Towards Early-Career Researchers

Analytical focus: How industry actors define relevant early-career researcher profiles and interpret academic research careers entering industry contexts.

Guiding questions:

1. What types of PhD or early-career researcher profiles are most relevant for your organisation?
2. When collaborating with or hiring ECRs, which competencies matter most in practice?
3. How do you perceive candidates coming primarily from academic research environments?
4. Are there differences in expectations between PhD candidates, postdocs and other ECR profiles?

Theme 2 – Recognition of Skills and Research Outputs

Analytical focus: How academic research outputs and skills are translated, interpreted or filtered within industrial environments.

Guiding questions:

1. Which types of research outputs are meaningful or valuable for your organisation?
2. How easy or difficult is it for you to assess the value of academic research outputs?

Funded by the European Union

3. Where do you most often see mismatches between academic training and industrial R&D needs?
4. Are there academic skills or experiences that tend to be undervalued or overlooked in industry?

Theme 3 – Collaboration with Academia and Supervision Interfaces

Analytical focus: How collaboration models and supervision interfaces function between academia and industry.

Guiding questions:

1. How are collaborations with universities or research organisations typically set up in your experience?
2. If you host or co-supervise PhD candidates or ECRs, how are roles and responsibilities defined?
3. What challenges arise in co-supervision or joint mentoring arrangements?
4. How well do academic supervision practices align with industrial working modes?

Theme 4 – Cross-Sector Mobility and Employment Transitions

Analytical focus: Industry perspectives on academic-to-industry mobility and career transitions.

Guiding questions:

1. How do you perceive transitions of PhDs or ECRs from academia into industry roles?
2. What typically limits or complicates recruitment of ECRs from academia?
3. How is prior academic experience valued in industrial career progression?
4. Do you observe barriers to mobility back into academia or hybrid careers?

Theme 5 – Inclusion, Diversity and Organisational Culture

Analytical focus: How organisational culture and working conditions influence inclusion, belonging and retention of ECRs.

Guiding questions:

1. How does your organisation approach inclusion and diversity in technical or research roles?
2. Are there specific challenges in attracting or retaining diverse research talent?
3. How do working conditions and organisational culture affect ECR integration?
4. Are there implicit norms that influence who succeeds or stays in deep tech roles?

Closing Reflection

„From your perspective as an employer which structural conditions most strongly influence whether research careers in deep tech are attractive and sustainable across academia and industry?“

ANNEX III – SURVEY STATISTICS AND RESULTS

On the next pages the survey statistics and results are provided.

Survey Results (Early Career Researchers)

SECTION A. Background & Research Profile

1. Which deep-tech domain best describes your research?
   - **Artificial Intelligence / Machine Learning** – 60.6 % (n=132)
   - **Advanced Materials / Nanotechnology** – 20.2 % (n=44)
   - **Robotics / Autonomous Systems** – 9.2 % (n=20)
   - **5G/6G Telecommunications** – 7.3 % (n=16)
   - **Quantum Technologies** – 1.8 % (n=4)
2. What is your current position?
   - **PhD students** – 72.5 % (n=158)
   - **Postdoctoral researchers** – 11.9 % (n=26)
   - **Junior researchers** – 10.1 % (n=22)
   - **Early-career engineers** – 4.6 % (n=10)
   - **PhD holder (other category)** – 0.9 % (n=2)
3. What is your gender?
   - **Male** – 77.1 % (n=168)
   - **Female** – 22.9 % (n=50)
4. Country of your institution:
   - **Bulgaria** 2
   - **Czech Republic** 98
   - **Greece** 74
   - **Slovakia** 18
   - **Spain** 16
   - **Estonia** 6
   - **Portugal** 2
   - **Bulgaria** 2
   - **France** 2
5. Have you previously worked in a deep-tech company?
   - **No** – 78.9 % (n = 172)
   - **Yes** – 21.1 % (n = 46)

Funded by
the European Union

SECTION B. **Research Environment & Infrastructure**

6. How would you rate your institution's access to specialised deep-tech infrastructure in your research domain (e.g., labs, HPC, fabrication facilities)? *(1–5 scale)*

Mean = 3.44. Access to labs, HPC, fabrication facilities and specialised infrastructure is rated as moderate to moderately good.

7. Have you collaborated with industry or tech organisations as part of your research?

- **Yes, occasionally** – 33.0 % (n=72)
- **Yes, regularly** – 27.5 % (n=60)
- **Rarely** – 19.3 % (n=42)
- **Never** – 20.2 % (n=44)

SECTION C. Recruitment, Contracts & Career Pathways

8. Was your recruitment process transparent and merit-based? *(1–5 scale)*

Mean = 4.21. Recruitment processes are perceived as strongly transparent and merit-based.

9. Do you understand the available career pathways in deep tech at your institution? *(1–5 scale)*

Mean = 3.36. Career progression clarity is significantly weaker than recruitment fairness.

10. What are the main barriers to your career development?

- **Unclear or uncertain career progression pathways** – 48.6 %
- **Too much pressure and uncertainty about future prospects** – 32.1 %
- **Lack of mentoring or clear guidance** – 31.2 %
- **Limited opportunities to connect, collaborate, or grow professionally** – 28.4 %
- **Limited chances for international mobility** – 22.9 %
- **Skills and achievements not sufficiently recognised** – 15.6 %
- **Experience of discrimination or unfair treatment** – 7.3 %
- **No significant barriers reported** – 0.9%

SECTION D. Skills, Training & Competence Gaps

11. To what extent do you need further development of the following transversal skills to support your career in deep tech?

- **Professional research skills (IP, entrepreneurship, grant writing, project management)** 3,79
- **Leadership & teamwork** 3,37
- **Communication & public engagement** 3,28
- **Time management & self-organisation** 3,03

Funded by
the European Union

12. How adequate is your institution's training offer? *(1–5 scale)*

Mean = 3.16 Training provision is perceived as moderate, but not fully sufficient for deep-tech career demands.

SECTION E. Mobility & Cross-Sector Collaboration

13. What factors prevent you from moving between academia and industry?

- **The working style and expectations are very different** 47.7%
- **I don't know enough about job or project opportunities in the other sector** 39.4%
- **It's unclear how to move between academia and industry** 37.6%
- **Experience from the other sector is not fully valued** 22.9%

14. Would you participate in an industry placement or startup internship?

- **Yes, definitely** – 32.1% (n=70)
- **Yes, maybe** – 47.7% (n=104)
- **Not sure** – 16.5% (n=36)
- **No** – 3.7% (n=8)

79.8 % (n=174) express positive openness to intersectoral mobility.

SECTION F. Open Science, Ethics & Responsible Innovation

15. Have you received training in the following areas?

- **Research integrity (ethical conduct, plagiarism, authorship, data manipulation)** 45.9%
- **Open Science (open access, data sharing, FAIR principles)** 39.4%
- **AI ethics and societal impacts** 35.8%
- **GDPR and data protection** 33.0%
- **Intellectual property & patent regulations** 22.9%
- **Environmental sustainability & compliance** 21.1%
- **No training in these areas** 24.8 %

16. How confident do you feel in your understanding and ability to apply the following topics in your deep-tech field? *(1–5 scale)*

- **Research Integrity** – 3.50 - highest
- **Open Science** – 3.30
- **AI Ethics** – 3.23
- **GDPR** – 3.10
- **Environmental Sustainability** – 2.97
- **IP & Patents** – 2.51 – lowest

Funded by
the European Union

SECTION G. Diversity, Inclusion & Research Culture

17. Did you observe any of the following inclusion-related barriers in your research environment?

- **No inclusion barriers observed** - 47.7 % (n = 104)
- **Limited inclusivity for international researchers** - 21.1 % (n = 46)
- **Language barriers affecting participation** - 21.1 % (n = 46)
- **Lack of inclusive institutional policies** - 12.8 % (n = 28)
- **Gender bias or discrimination** - 9.2 % (n = 10)
- **Harassment or inappropriate behaviour** - 8.3 % (n = 18)
- **Lack of support for researchers with disabilities** - 3.7 % (n = 8)

SECTION H. Future Aspirations & Recommendations

18. What is your preferred long-term deep-tech career path?

- **Academic research** – 46.8 % (n = 102)
- **Industrial R&D** – 30.3 % (n = 66)
- **Startup founder / entrepreneurship** – 11.0 % (n = 24)
- **Consulting / technology strategy** – 8.3 % (n = 18)
- **Hybrid academic–industry orientation** – 0.9 % (n = 2)
- **Science research either in academia or industry** – 2.7 % (n = 6)

19. To what extent would the following changes improve deep-tech career development at your institution? *(1–5 scale)*

- **Increased funding for early-career researchers** – 4.20
- **Stronger industry collaboration** – 3.95
- **Stronger mentoring & supervision** – 3.75
- **More international mobility opportunities** – 3.72
- **Clear & structured career development** – 3.70

Funded by
the European Union

Annex III.B Survey Results (Academia, RPOs)

SECTION A. Organizational Profile

1. What type of research-performing organization are you?
- **University: 66.7 % (n = 52)**
- **Public research center: 25.6 % (n = 20)**
- **Private research organization: 7.7 % (n = 6)**

2. How many researchers do you employ (approx.)?
- **1000+**: 30.8 % (n = 24)
- **50–199**: 25.6 % (n = 20)
- **500–999**: 23.1 % (n = 18)
- **200–499**: 12.8 % (n = 10)
- **Fewer than 50**: 7.7 % (n = 6)

3. Country of your main institution:
- **Czech Republic:** n = 18
- **Greece:** n = 12
- **Spain:** n = 10
- **Italy:** n = 6
- **Cyprus / Portugal / France / Romania:** n = 4 each
- **Finland, Lithuania, UK, Denmark, Belgium, Poland, Croatia, Austria:** n = 2 each

4. Does your organization work in deep-tech areas (AI, robotics, quantum, advanced materials, 5G/6G telecom)?
- **Yes, partially**: 48.7 % (n = 38)
- **Yes, primarily**: 35.9 % (n = 28)
- **Minimally**: 15.4 % (n = 12)

SECTION B. Charter Implementation & HR Excellence

5. Does your institution hold the HR Excellence in Research Award?
- **Yes**: 38.5 % (n = 30)
- **In progress (committed)**: 20.5 % (n = 16)
- **No, but considering it**: 23.1 % (n = 18)
- **No and NOT considering**: 15.4 % (n = 14)

6. Which principles of Charter for Researchers are most challenging to implement?
- **Insufficient information to answer**: 48.7 % (n = 38)
- **Career development**: 28.2 % (n = 22)
- **Recruitment & selection**: 25.6 % (n = 20)
- **Working conditions**: 23.1 % (n = 18)
- **Gender equality**: 15.4 % (n = 12)

Funded by
the European Union

7. What are the main barriers to implementing the Charter?
- **Insufficient information to answer**: 46.2 %
- **Insufficient funding**: 33.3 %
- **Lack of staff capacity**: 25.6 %
- **Administrative constraints**: 23.1%
- **Limited institutional awareness**: 15.4%

SECTION C. Working Conditions & Research Culture

8. To what extent are the following support structures for Early-Career Researchers established and functioning in your institution? *(1–5 scale)*
- **Clear guidelines for researcher roles & evaluation:** 3.18
- **HR guidance and individual support:** 2.64
- **Mentoring programmes:** 2.54
- **Structured onboarding of ECRs:** 2.49
- **Training for supervisors:** 2.41
- **Career development services for deep-tech ECRs:** 2.28

SECTION D. Training & Skills Development

9. What training is needed in your institution in the following areas for early career researchers (ECRs)?
- **Project & time management**: 71.8 %
- **Communication**: 61.5 %
- **Teamwork & leadership**: 61.5 %
- **Industry-oriented practical skills**: 59.0 %
- **Responsible research & open science**: 51.3 %
- **Deep-tech technical skills**: 48.7 %
- **Technology transfer & IP**: 46.2 %

SECTION E. Collaboration & Mobility

10. How often does your organization collaborate with industry?
- **Regularly (ongoing strategic partnerships)**: 46.2 % (n = 36)
- **Frequently (multiple projects/activities)**: 38.5 % (n = 30)
- **Occasionally**: 10.3 % (n = 8)
- **Rarely**: 5.1 % (n = 4)

11. What factors limit mobility between academia and industry at your institution?
- **Administrative & bureaucratic barriers**: 59.0 %
- **IP / legal concerns / funding constraints**: 43.6 %
- **Differences in working conditions & career structures**: 38.5 %
- **Limited institutional support for mobility**: 23.1 %
- **Lack of industry contacts**: 20.5 %

- For a scientific institution of basic research there is a limited motivation for mobility to/from industry/Very few real industries in the territory: 6,9 %

Funded by the European Union

SECTION F. Gender Equality & Inclusion

12. Do you implement a Gender Equality Plan?

- **Yes**: 84.6 % (n = 66)
- **In progress**: 10.3 % (n = 8)
- **No, but considering**: 2.6 % (n = 2)
- **No and NOT considering**: 2.6 % (n = 2)

13. To what extent do the following inclusion challenges persist in your institution? *(Scale: 1 = Not serious … 5 = Extremely serious)*

- **Diversity in leadership**: 2.79
- **Support for international researchers**: 2.46
- **Gender imbalance**: 2.44
- **Accessibility challenges**: 2.36
- **Recruitment bias**: 2.33

SECTION G. Strategic Needs & Future Priorities

14. To what extent would the following measures help your institution improve the implementation of the European Charter for Researchers? *Scale: 1 = Would not help … 5 = Would help very significantly*

- **Better training & professional development programmes**: 3.64
- **Improved institutional digital tools & processes**: 3.54
- **Strengthened HR & research support capacity**: 3.49
- **Stronger leadership commitment & clearer national/EU guidance**: 3.49
- **Increased funding for HR development**: 3.36

Funded by
the European Union

Annex III.C Survey Results (Industry)

SECTION A. Company Profile

1. What is the size of your company?
   - **Large enterprise – 34.5 % (n = 20)**
   - **SME (50–249 employees) – 31.0 % (n = 18)**
   - **Small company (<50 employees) – 24.1 % (n = 14)**
   - **Micro-enterprise / startup – 10.3 % (n = 6)**
2. How many researchers or research-related employees do you have?
   - **Primarily deep-tech company – 58.6 % (n = 34)**
   - **Partially active in deep-tech – 34.5 % (n = 20)**
   - **Minimally active – 6.9 % (n = 4)**
3. In which EU countries does your company actively operate? Please indicate countries where your company has operational activities, such as offices, production sites, R&D centres, or regular business operations.)
   - **Greece** – n = 14
   - **Czech Republic** – n = 12
   - **Spain** – n = 10
   - **Italy** – n = 6
   - **Others (France, Portugal, etc.)** – n ≤ 4 each

SECTION B. Skills Needs & Workforce Challenges

4. Which deep-tech domains does your company operate in?
   - **AI / Machine Learning** – 75.7 %
   - **Telecommunications (5G/6G)** – 44.8 %
   - **Robotics** – 31.0 %
   - **Advanced Materials** – 31.0 %
   - **Quantum Computing** – 24.1 %
5. To what extent are the following transversal skills lacking among deep-tech candidates and Early-Career Researchers from your perspective? *Scale 1 not lacking – 5 critically lacking*
   - **Understanding of IP and regulations** – 3.32
   - **Business and commercial awareness** – 3.28
   - **Project & time management** – 3.04
   - **Communication & teamwork** – 2.88
   - **Problem-solving, innovation & creativity** – 2.16

SECTION C. Collaboration with Academia

6. How would you describe your company's overall level of collaboration with universities or research institutes?
   - **Very active and strategic collaboration** – 62.1 %

Funded by
the European Union

- **Occasional and project-based collaboration** – 31.0 %
- **Limited and informal collaboration** – 3.4 %
- **No collaboration yet, but interested** – 3.4 %
- **Legal barriers to collaborating** – 3.4 %

7. To what extent do the following factors limit effective collaboration between your company and academic or research institutions? *Scale – 1 not barrier, 5 major barrier*

- **Slow academic timelines** – 3.31
- **Limited flexibility of academic structures** – 3.21
- **IP/legal/funding constraints** – 3.10
- **Administrative complexity** – 3.07
- **Skill mismatch** – 2.69

SECTION D. Mobility, Internships & Talent Pipelines

8. Are you interested in hosting internships or placements for Early Career Researchers?

- **Yes – 51.7 % (n = 30)**
- **Maybe – 13.8 % (n = 8)**
- **Not currently – 34.5 % (n = 20)**

9. What measures make it easier for your company to host Early-Career Researchers?

- **Financial support for hosting Early-Career Researchers** – 79.3 %
- **Clear and simplified procedures (legal, IP, administrative)** – 62.1 %
- **Better matching between company needs and ECR profiles** – 48.3 %
- **Dedicated coordination and mentoring support from universities** – 41.4 %
- **Shorter and more flexible placement schemes** – 24.1 %
- **Other (isolated response)** – 3.4 %

SECTION E. Working Conditions & Career Pathways

10. What career pathways do you offer for researchers?

- **R&D engineer** – 79.3 %
- **Scientist / researcher** – 51.7 %
- **Product developer** – 44.8 %
- **Innovation manager** – 41.4 %
- **Data scientist** – 27.6 %

11. How well developed are the following onboarding and training practices for new researchers in your company? *Scale – 1 not provided – 5 very well developed*

- **Formal onboarding programme** – 3.57
- **Safety & regulatory training** – 3.54
- **Technical training related to deep-tech roles** – 3.52
- **Structured mentoring for new researchers** – 3.40
- **Soft-skills training & introduction to innovation/R&D workflows** – 3.12

SECTION F. Open Innovation & Collaboration Models

12. Do you participate in open innovation challenges?

- **Yes – 55.2 %**
- **Occasionally – 24.1 %**
- **Not yet, but interested – 20.7 %**

13. What types of innovation challenges would be valuable for your company?

- **Technical challenges (solving specific technological problems)** – 72.4 %
- **Joint research & development initiatives with academic partners** – 72.4 %
- **Market-driven challenges (focused on customer or application needs)** – 62.1 %
- **Pilot testing and demonstration programmes** – 62.1 %
- **Open innovation calls with external partners** – 55.2 %

SECTION G. Expectations & Future Needs

14. What support would help your company attract deep-tech talents?

- **Better collaboration & matching tools between academia and industry** – 65.5 %
- **Better training & placement programmes** – 51.7 %
- **Greater visibility of opportunities (e.g., platforms, networking)** – 48.3 %
- **Access to academia (labs, expertise, infrastructure)** – 34.5 %
- **International recruitment support** – 27.6 %

Funded by
the European Union

ANNEX IV FOCUS GROUPS ANALYTICAL SUMMARY

On the next pages the focus groups analytical summary is provided.

Annex IV.A Integrated Focus Group Analytical Summary (Early-Career Researchers)

Integrated Early-Career Researchers Focus Group Analytical Summary

1. Purpose & context

Two focus groups with early-career researchers (ECRs) were conducted within Task T2.1 of the DeepTechSeeds project to explore career trajectories, working conditions, mentoring structures, mobility perspectives and institutional environments shaping early-stage research careers in deep-tech domains.

The discussions included doctoral candidates and early-stage researchers from multiple European contexts and institutions, representing fields such as robotics, artificial intelligence, telecommunications, advanced materials, optics, biotechnology and related deep-tech areas. The focus groups formed part of a triangulated qualitative research design alongside industry and academic stakeholder discussions and survey data.

2. Methodological note

Both sessions followed a semi-structured discussion format organised around predefined thematic areas:

- career development and future perspectives,
- evaluation of research outputs,
- project-based working conditions,
- mentoring and institutional support,
- academia–industry interaction and mobility.

Sessions were conducted online, recorded and anonymised. The analysis applied thematic coding aligned with a triangulation framework and interpreted through a realist evaluation perspective focusing on context–mechanism–outcome relationships shaping ECR experiences.

3. Participant overview

Participants (12) included doctoral candidates and early-stage researchers from:

- technical universities and research institutes in Central and Eastern Europe and broader European research environments,
- interdisciplinary deep-tech domains including AI/ML, robotics, advanced materials, photonics, telecommunications and biomedical engineering.

Participants represented different stages of doctoral training (early PhD to near completion) as well as hybrid academia–industry roles.

Funded by the European Union

4. Key themes

Theme 1 — Project dependency and career uncertainty

Across participants, early-career trajectories were strongly linked to project-based funding structures. Employment continuity, contract renewal and research opportunities were frequently tied to grant success.

Many participants described career planning horizons limited to short-term periods (typically one to three years), reflecting uncertainty linked to funding cycles. Financial considerations, including low doctoral stipends in some contexts, influenced career decisions and increased interest in industry pathways.

Theme 2 — Evaluation gaps and invisible academic labour

Participants highlighted a perceived mismatch between formal evaluation systems and the full scope of academic work. Publications and project participation were commonly valued outputs, while activities such as mentoring students, maintaining research infrastructure, developing methods or supporting collaborative processes were often seen as under-recognised.

Applied research topics sometimes faced additional challenges due to lower citation visibility despite high practical relevance.

Theme 3 — Mentoring structures: informal support vs formal systems

Support structures were frequently described as informal and dependent on supervisors, senior colleagues or peer networks rather than systematic institutional mentoring frameworks.

Participants valued peer mentoring and collaborative learning environments but identified gaps in structured career guidance, particularly in areas such as:

- long-term career planning,
- grant strategy development,
- leadership and project management skills,
- industry transition pathways.

Theme 4 — Interdisciplinarity and adaptive career identities

ECRs often described interdisciplinary trajectories spanning multiple domains or institutional contexts. While interdisciplinarity was perceived as beneficial and necessary in deep-tech environments, institutional structures and evaluation systems sometimes lagged behind these hybrid career paths.

Participants expressed both interest and uncertainty regarding interdisciplinary career progression and recognition.

Theme 5 — Academia–industry mobility and hybrid careers

Interaction between academia and industry was common through collaborative projects or applied research activities. Many participants viewed cross-sector mobility as valuable but associated it with risks, including:

- uncertainty about recognition of industrial experience within academic careers,
- potential interruptions to publication trajectories,
- lack of structured institutional support for transitions between sectors.

Funded by
the European Union

Motivations for industry engagement were frequently linked to financial stability and applied impact rather than rejection of academic research itself.

5. Contribution to triangulation

The ECR focus groups provided direct insight into lived experiences of early-stage researchers, complementing perspectives from academic and industry stakeholders.

Findings confirmed cross-stakeholder themes including:

- project-based research environments shaping career stability,
- misalignment between evaluation systems across sectors,
- reliance on informal mentoring structures,
- structural barriers influencing cross-sector mobility.

ECR perspectives added nuanced understanding of perceived risks, emotional dimensions of career uncertainty, and the practical implications of institutional structures on individual decision-making.

6. Key takeaways

- **Early-career research trajectories in deep-tech environments are strongly shaped by funding structures and project cycles.**
- **Formal evaluation systems do not fully capture the breadth of academic contributions performed by ECRs.**
- **Mentoring is critical but remains largely informal and uneven across institutional contexts.**
- **Interdisciplinary career paths are increasingly common but insufficiently supported structurally.**
- **Cross-sector mobility is valued but constrained by evaluation frameworks and institutional incentives.**

Funded by the European Union

Annex IV.B Focus Group Analytical Summary (Academia, RPOs)

Academia Focus Group Analytical Summary

1. Purpose & context

The academia focus group was conducted within Task T2.1 of the DeepTechSeeds project to capture institutional perspectives on early-career researcher (ECR) career development, mentoring practices, evaluation structures, and cross-sector mobility in deep-tech research environments.

Participants represented universities and research institutes across different European contexts and disciplinary areas including telecommunications, control engineering, optics, artificial intelligence and applied research domains. The discussion explored institutional realities shaping career pathways, differences between formal and actual career structures, and the interaction between academic systems and industry collaboration.

The focus group forms part of a triangulated qualitative research design integrating industry and early-career researcher perspectives.

2. Methodological note

The session followed a semi-structured discussion format organised around predefined thematic areas:

- institutional career structures and trajectories,
- supervision and mentoring practices,
- evaluation frameworks,
- cross-sector mobility between academia and industry.

The session was conducted online and recorded for analytical purposes. Data were analysed using thematic coding aligned with the triangulation framework and interpreted through a realist evaluation perspective examining context–mechanism–outcome dynamics shaping institutional environments.

3. Participant overview

Participants (6) included:

- academic supervisors and senior researchers,
- representatives of research centres and universities,
- institutions from multiple European regions (CZ, ESP, GRE).

Disciplinary backgrounds covered telecommunications, photonics and optics, AI-related research, engineering sciences and applied technology domains.

Participants provided perspectives informed by both institutional governance and direct experience supervising early-career researcher.

4. Key themes

Theme 1 — **Formal vs actual academic career pathways**

Participants described a distinction between formally defined career structures (e.g., tenure-track or contract-based progression) and the realities of project-driven academic employment. Career

Funded by
the European Union

trajectories are strongly influenced by national legislation, institutional policies and availability of external funding.

Early-career progression was frequently described as dependent on project participation and supervisor support rather than strictly formalised institutional pathways. Differences between idealised academic career expectations and practical realities were highlighted.

Theme 2 — **Administrative burden and structural pressures**

Academic stakeholders emphasised increasing administrative workload and institutional responsibilities that compete with research time. Participants described tensions between expectations of scientific productivity and administrative obligations, suggesting that early-career researchers may experience conflicting demands between research and institutional duties.

Theme 3 — **Mentoring and supervision practices**

Mentoring was widely described as highly individualised and dependent on supervisor practices rather than institutionalised frameworks. Successful mentoring environments were associated with strong research group cultures and informal support networks.

Formal institutional structures supporting mentoring were perceived as limited or unevenly implemented. Variability in supervision quality was identified as a structural issue influencing early-career development.

Theme 4 — **Cross-sector mobility and institutional recognition**

Participants reported increasing collaboration between academia and industry, including industrial PhDs, joint projects and startup creation. However, structural barriers remain:

- industrial experience often insufficiently recognised in academic evaluation,
- returning from industry to academia can be difficult,
- non-linear career paths are not consistently supported.

Mobility was generally encouraged rhetorically but constrained by institutional incentives and evaluation systems.

Theme 5 — **Role of supervisors and research groups in career shaping**

Participants highlighted the strong influence of supervisors on research topics, career trajectories and opportunities. Research group culture and local practices were often more influential than institutional policies in shaping early-career experiences.

5. Contribution to triangulation

Academic perspectives reinforced findings from industry and early-career researcher focus groups, particularly:

- project-based funding structures shaping career stability,
- mentoring systems relying heavily on informal practices,
- structural misalignment between academic and industrial evaluation systems,
- challenges in enabling effective cross-sector mobility.

Funded by the European Union

Academic stakeholders provided additional insight into institutional constraints, legislative frameworks and organisational dynamics influencing career development.

6. Key takeaways

- **Academic career pathways remain strongly shaped by external funding and project cycles despite formal structures.**
- **Administrative pressures influence research practices and early-career development.**
- **Mentoring quality varies significantly and depends largely on individual supervisors.**
- **Cross-sector mobility is increasing but remains structurally constrained.**
- **Institutional systems often lag behind evolving interdisciplinary and hybrid career models in deep-tech environments.**

Funded by
the European Union

Annex IV.C Focus Group Analytical Summary (Industry)

Industry Focus Group Analytical Summary

1. Purpose & context

The industry focus group was conducted within Task T2.1 of the DeepTechSeeds project to explore industry perspectives on early-career researchers (ECRs) in deep-tech environments. The discussion focused on expectations regarding competencies, research outputs, collaboration models with academia, and cross-sector mobility between academic and industrial research environments.

The focus group formed part of a triangulated research design alongside surveys and focus groups with early-career researchers and academic stakeholders, aiming to capture multiple perspectives on career development in deep-tech domains.

2. Methodological note

The session followed a semi-structured discussion format covering predefined thematic areas, including recruitment expectations, skills requirements, evaluation of research outputs, industry–academia collaboration practices, and mobility patterns.

Participants were invited to share practical experiences based on organisational practices. The session was conducted online and recorded for analytical purposes. Data analysis applied thematic coding aligned with the broader triangulation framework and realist evaluation perspective adopted in the deliverable.

3. Participant overview

Participants (6) represented diverse deep-tech industry environments, including:

- SMEs and larger research-oriented companies,
- industrial R&D teams and recruitment specialists,
- domains such as advanced materials, optics and photonics, telecommunications (5G/6G), automotive R&D, and space technologies.

Participants came from multiple European regions (Central/Eastern, Southern and Northern Europe), providing cross-context insights into industrial expectations and collaboration practices.

4. Key themes

Theme 1 — **Desired researcher profiles and competencies**

Industry stakeholders emphasised interdisciplinary skills, flexibility, and the ability to rapidly learn new domains as critical competencies for early-career researchers. Small and specialised research teams require adaptable researchers capable of working across multiple technical areas rather than narrow specialisation.

Soft skills such as motivation, openness, teamwork and communication abilities were repeatedly highlighted as equally important as technical expertise. Programming skills and familiarity with emerging tools (e.g., data analysis or AI-related approaches) were frequently mentioned.

Funded by
the European Union

Theme 2 — Academic vs industrial research cultures

Participants identified structural differences between academic and industrial environments:

- academia prioritises scientific exploration and publication,
- industry emphasises functionality, application and time-to-market.

A recurring challenge concerns transitioning from academic perfection-oriented approaches to industrial environments where iterative development and practical usability are prioritised.

Theme 3 — Valued research outputs

Industrial stakeholders highlighted that valuable outputs include:

- prototypes and demonstrators,
- methodologies and standards,
- intellectual property and patents,
- applied solutions supporting product development.

Publications were considered valuable but secondary to practical applicability or strategic relevance. Participants emphasised the importance of developing IP awareness among early-career researchers.

Theme 4 — Collaboration models between academia and industry

Collaboration with academia was described as essential for innovation. Common collaboration mechanisms included:

- co-supervised PhD projects,
- internships and embedded researchers,
- joint research projects and European programmes.

Successful collaborations depend on early alignment of objectives, clear definition of roles, and early agreement on intellectual property management. Differences in timelines and expectations between academia and industry were identified as potential friction points.

Theme 5 — Cross-sector mobility

Mobility between academia and industry was generally viewed positively and increasingly common in research-intensive sectors. Participants reported frequent movement of researchers between sectors, although structural factors such as evaluation criteria or contract conditions may influence mobility decisions.

Exposure to industry was perceived as beneficial for strengthening applied research understanding and improving collaboration capabilities.

5. Contribution to triangulation

Industry perspectives confirmed several patterns emerging from early-career researcher and academic focus groups, particularly:

- the importance of interdisciplinary skills,
- systemic differences between academic and industrial evaluation cultures,
- reliance on informal mechanisms in mentoring and collaboration,
- structural barriers affecting cross-sector mobility.

Funded by the European Union

The industry focus group added nuanced insights into organisational expectations, intellectual property considerations, and practical constraints shaping research collaboration.

6. Key takeaways

- **Industry prioritises adaptable and interdisciplinary researcher profiles.**
- **The primary gap between sectors lies in research culture and evaluation systems rather than technical skills.**
- **Practical outputs and intellectual property awareness are central to industrial research environments.**
- **Academia–industry collaboration is widespread but requires clear governance and alignment of expectations.**
- **Cross-sector mobility is valued but remains influenced by structural and institutional factors.**

Funded by
the European Union

Annex V – Pillar-Specific National Nuances in Charter Implementation

Country	Working Conditions & Career Stability	Evaluation & Recognition	Dissemination & IP Governance	Mobility & Inclusion
Spain	Strong institutional buffering within coordinated system; comparatively higher structural stability	Publication-centred evaluation persists despite strong innovation agenda	Structured IP mediation; hybrid governance manageable through institutional capacity	Mobility strategically supported; recognition of industrial experience still uneven
France	Greater structural stability within coordinated research organisations	Traditional academic metrics remain dominant in promotion systems	Clear IP governance in structured national organisations; mediation capacity strong	Formal cooperation structures exist; reintegration practices vary by institution
Portugal	Grant dependency visible; transition buffering limited in project cycles	Innovation discourse stronger than evaluation reform depth	Growing industry collaboration; IP literacy uneven at early-career level	Mobility encouraged; career sequencing clarity remains limited
Czechia	Contract instability linked to project funding; institutional variance significant	Evaluation inertia stronger in traditional academic environments	Technology transfer structures present but uneven in depth and capacity	Intersectoral mobility increasing; reintegration mechanisms underdeveloped
Greece	Higher employment volatility; strong reliance on EU-funded research cycles	Evaluation reform evolving; uneven institutional implementation	IP governance capacity variable across institutions; mediation complexity present	Mobility structurally supported but procedurally complex
Malta	Small-system flexibility combined with structural vulnerability to funding shifts	Evaluation strongly influenced by publication norms	Limited scale affects IP mediation capacity and specialised support structures	Mobility high at individual level; formal reintegration pathways limited

Funded by the European Union