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Research Funders for Quantum Technologies

Revised "QuantERA RRI guidelines for research community" with a focus on gender equality in research community

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Revised "QuantERA RRI guidelines for research community" with a focus on gender equality in research community

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List of Acronyms

CSC	Call Steering Committee
EC	European Commission
EDI	Equity, Diversity and Inclusion
ERA	European Research Area
GA	Grant Agreement
GE	Gender equality
PC	Project Coordinator
PI	Principal Investigator
QS&T	Quantum Science and Technologies
QT	Quantum Technologies
R&I	Research & Innovation
RFO	Research Funding Organisation
RPO	Research Performing Organisation
RRI	Responsible Research and Innovation
SDG	Sustainable Development Goals
WG	Working Group
WP	Work Package

Definitions

'Call' means a QuantERA call for proposals, which can be cofunded by the EU or not.

'Consortium' means all QuantERA Parties working collaboratively towards the realisation of the Programme under the Consortium Agreement signed by them.

'ERA' (European Research Area) means an unified research space across the European Union and associated countries, aimed at enabling free circulation of researchers, scientific knowledge, and technology.

'Evaluation Panels' means the group of independent, scientific experts evaluating the proposals submitted within the Call.

'Project' is a project funded under the QuantERA Call.

'Programme' is a QuantERA initiative as a whole, including its Calls, coordination, and strategic framework

'Research Funding Organisation' means a national or regional agency responsible for providing a national or regional share of funding for the transnational Projects[1].

[1] QuantERA RFOs mentioned in this document are referred to by acronyms; full names are available at: https://quantera.eu/consortium/.

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Introduction & Purpose

Quantum technologies are progressing swiftly from experimental settings to operational environments, with significant implications for computing, communication, sensing and simulation. This transition offers substantial societal and economic opportunities, while also raising complex challenges that require strategic foresight and responsible governance. **As emphasised in the *Quantum Europe Strategy* (July 2025)** [2]:

> *"Europe must act decisively to become a quantum powerhouse. This means not only investing in excellence and industrial uptake, but also ensuring societal trust, ethical foresight and inclusive innovation across the entire quantum ecosystem."*

The aim of this revised edition of the *QuantERA Responsible Research and Innovation (RRI) Guidelines* is to support the operationalisation of RRI principles by drawing recommendations from experience. Rather than prescribing fixed templates, the Guidelines offer tested practices, examples, and strategic reflections that can be adapted to different institutional contexts. By highlighting both progress and remaining gaps, the document contributes to a shared understanding of what it means to do quantum research responsibly — and why it matters.

This document captures the evolution of RRI policy and practice in the field of quantum science and technology, with the special focus put on gender equity in performing and managing quantum research projects and programmes, throughout the lifetime of the QuantERA I and QuantERA II Programmes (2016–2025)[3]. It builds upon the 2018 guidelines developed under QuantERA I (2016-2022)[4], and reflects the experience accumulated during the ongoing implementation of QuantERA II (2021–2026), implemented under the European Union's Horizon 2020 Research and Innovation Programme. The document also situates QuantERA III, launched in mid-2025, within the evolving Horizon Europe framework, which places stronger emphasis on sustainability, inclusiveness, and accountability.

The Guidelines, in turn, address the broader transformation of European research governance: RRI has moved from the realm of awareness-raising to that of structured implementation, evaluation, and accountability. Sustainability, equity, openness and public engagement are no longer optional — they are embedded into calls, procedures, and institutional expectations. QuantERA II has embraced this transformation by integrating RRI principles at Programme, RFOs, and Projects levels. The document also offers both strategic considerations and practical experiences gathered during QuantERA II Task 5.4: *Towards more gender-balanced quantum technologies*, led by AEI (Spain) in collaboration with FECYT, implemented under Work Package (WP) 5 on communication, exploitation and dissemination.

[2] European Commission, *Quantum Europe Strategy*, 2025.
[3] The programme implemented in 2016–2022 was officially called "QuantERA", but is retrospectively referred to as "QuantERA I" to highlight its place in the three-programme sequence collectively known as QuantERA.
[4] QuantERA, *Guidelines in Responsible Research and Innovation in QT*, 2018.

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Revisiting RRI in QuantERA: Changes and Continuities Since 2018

This version of the RRI Guidelines builds on the foundations laid in Deliverable D6.2, *Guidelines in RRI in QT*, published in 2018 as part of the actions undertaken under QuantERA I[5]. That document introduced the key dimensions of RRI — including ethics, public engagement, gender equality, open access, and science education — and encouraged their integration into quantum research projects. At the time, sustainability was not treated as a standalone category but rather embedded within broader notions of ethics and responsibility.

Since then, both the policy context and societal needs have shifted significantly. The launch of *Horizon Europe* marked a turning point, with its stronger emphasis on measurable impact, inclusion, and alignment with strategic EU priorities — such as the European Green Deal[6], digital and green transitions, and technological sovereignty. Simultaneously, the global research community has seen growing demand to address systemic risks, promote resilience, and respond to the Sustainable Development Goals (SDGs)[7]. In the field of inclusiveness, one of the most significant developments has been the mandatory introduction of Gender Equality Plans (GEPs) as an eligibility criterion for public institutions applying for funding[8].

These shifts have reshaped the role of RRI. What was once a set of aspirational principles is now expected to be practically embedded in research governance, programme design, and funding operations.

Within this changing landscape, QuantERA II has made visible progress, consistently strengthened by its commitment to meeting the evolving priorities of Horizon Europe, which now governs the new edition of the Programme. Sustainability in the field of research and development is no longer treated as an implicit value but is increasingly addressed through concrete practices and frameworks.

The updated Guidelines reflect this evolution, highlighting how responsibility is now approached through the lens of:

Inclusive research cultures, with particular attention to gender equality and equity, support for early-career researchers, and capacity building in less research-performing countries**;**

Open and transparent science, including accessible publishing and data-sharing infrastructures — balanced with responsible management of sensitive information and awareness of research security risks inherent in quantum technologies;

Anticipation and reflection on the ethical, social, and security implications of quantum technologies;

Reaching the general public and fostering a shared understanding of quantum technologies, which is essential, given their transformative and innovative potential.

RRI is not a one-size-fits-all model. It is a flexible, adaptive approach to embedding societal responsibility across diverse research contexts. In quantum research — a field both

[5] QuantERA, *Guidelines in Responsible Research and Innovation in QT*, 2018.
[6] European Commission, *The European Green Deal*, 2019.
[7] The Sustainable Development Goals (SDGs) are a universal set of 17 goals adopted by all United Nations Member States in 2015 as part of the 2030 Agenda for Sustainable Development: United Nations, The 17 Goals – Sustainable Development Agenda, 2015.
[8] European Commission, *Horizon Europe Guidance on Gender Equality Plans*, 2021.

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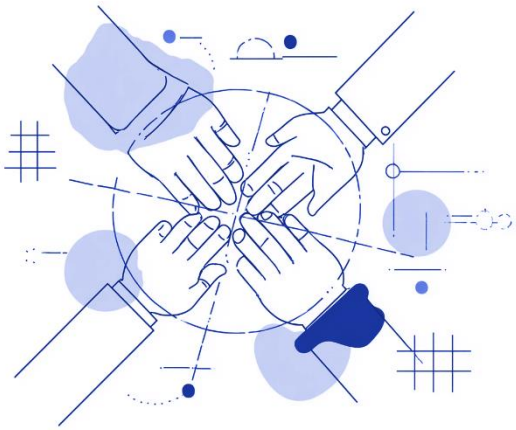
exploratory and sensitive — four interlinked dimensions help translate RRI from principle to practice[9]:

- **Anticipation**: Encourages reflection on the possible effects — both intended and unintended — of research activities. It fosters preparedness and early identification of risks, especially in ethically or geopolitically sensitive domains.
- **Inclusion**: Promotes early and active engagement with relevant stakeholders, including users, affected communities, or civil society actors. This supports more robust problem-framing and encourages inclusive research directions.



- **Reflexivity**: Creates intentional space to examine assumptions, values, and blind spots that shape research agendas and programme design — a particularly valuable practice in high-stakes or rapidly developing technological areas.
- **Responsiveness**: Invites openness to change when new knowledge, public concerns, or ethical dilemmas emerge. It recognises that scientific and innovation processes require flexibility and iteration.

These dimensions may help researchers and funders build **responsiveness into research management** — enabling quantum technologies to evolve in step with societal expectations and shared European values. They also align closely with broader policy frameworks in Horizon Europe, including sustainability, openness, and research security.

Yet, challenges persist. The integration of RRI principles remains uneven, capacities differ between institutions, and there is still a need for tools, training, and long-term commitment. Recognising both achievements and gaps, this document offers a refreshed starting point. It positions RRI not as abstract ideals, but as practical, shared responsibilities embedded in the evolving European research ecosystem.

From Principles to Practice: RRI Implementation in QuantERA II

RRI real value lies in how it is translated into practice — across both funding mechanisms and academic and research activities. In QuantERA II, RRI principles were embedded at multiple levels, reflecting growing institutional awareness and experimentation with responsible governance models.

[9] These four dimensions were originally articulated by Stilgoe, Owen and Macnaghten in their influential framework for responsible innovation developed with the UK Engineering and Physical Sciences Research Council (EPSRC). See: Stilgoe, J., Owen, R., & Macnaghten, P., *Developing a framework for responsible innovation*, Research Policy, 42(9), 2013, pp. 1568-1580.

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Institutional Frameworks and Funders' Practices

At the network level, QuantERA undertakes a range of awareness-raising and communication activities to mainstream QT and inclusiveness in this field. These efforts include maintaining a dedicated RRI section on the website[10], organising conference panels that address RRI in general as well as gender balance aspects[11], ensuring gender-sensitive representation at QuantERA events, or striving towards reaching the wider public. An example of the latter was launching the short video contest *'Different Shades of Quantum Technologies'*[12] aimed at engaging a broad public audience."

Regarding activities on the level of individual QuantERA partner organisation, and as part of the work on mapping of public policies in Quantum Technologies (Task 6.4) realised in 2023 QuantERA examined how Research Funding Organisations (RFOs) address Responsible Research and Innovation (RRI) in the context of Quantum Technologies. The result reveals an uneven landscape of engagement in the field of RRI among RFOs. This analysis was based on open, self-reported surveys, completed by RFOs, and thus reflects varying levels of detail and reporting depending on institutional context[13]. Notably, most efforts focus on gender balance and open access. It is important to note that many of the identified measures are not limited to quantum research but apply across all scientific domains, with relevance to quantum as part of this broader framework. To help translate these lessons into practical guidance, the active measures identified have been grouped by thematic category below – also showcasing selected examples of original good practices from across the network.

Equality and diversity

- **Gender Equality Plans** – RFOs within the QuantERA network developed and implemented GEPs at different points in time, reflecting their national contexts and institutional readiness. While GEPs were encouraged under Horizon 2020, they became a formal eligibility requirement for public institutions applying for funding under Horizon Europe. In line with this policy, all QuantERA III RFOs have a valid GEP. Furthermore, in the field of formalised activities supporting gender equality, it is worth noting, for example, that **FNR** (Luxembourg) coordinates a **National Gender Working Group** aimed at developing concrete actions to minimise imbalances.
- **Promoting gender balance beyond formal GEPs** – In addition to meeting the Horizon Europe requirement for institutional Gender Equality Plans, many funding agencies have demonstrated a broader commitment to addressing gender imbalances. This includes encouraging gender-balanced research teams, integrating gender considerations into evaluation processes, and supporting internal awareness-raising and communication activities related to equity and inclusion.
- **Support for under-represented or early-career researchers** – Promoting inclusion in research, including quantum area, also involves targeted support for early-career researchers and individuals from under-represented groups. Several funding agencies within the QuantERA network have developed dedicated measures, such as specific calls, tailored national schemes, or targeted budget allocations. For example:
  – **TÉ–RI** (Ireland) and **AEI** (Spain) offer initiatives specifically aimed at young researchers (in the case of AEI, via a dedicated call);

[10] See: https://quantera.eu/responsible-research-innovation.
[11] For example, the panels "Empowering Women in Quantum: Driving Diversity" and "Quantum and Society" were organised during the QuantERA Strategic Conference 2024 (24–25 September, Amsterdam).
[12] See: https://quantera.eu/short-video-contest-different-shades-of-quantum-technologies.
[13] QuantERA, *Quantum Technologies. Public Policies in Europe*, 2023.

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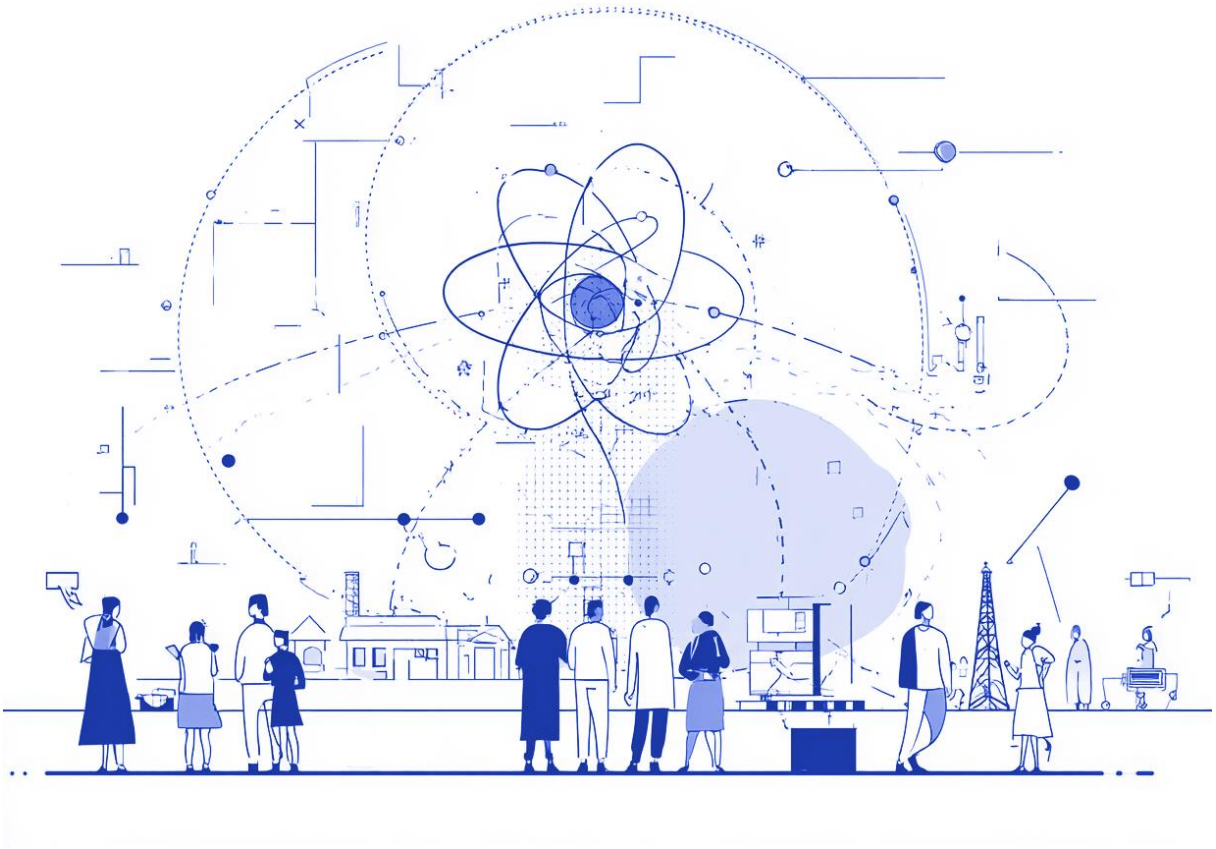
– **NCN** (Poland) devotes more than half of its annual budget to early-career scientists;
– **NWO** (Netherlands) supports inclusiveness through programmes such as *Aspasia* and the national initiative *Quantum Delta NL*[14];
– **SAS** (Slovakia) promotes early-career development through the *SASPRO 2*[15] and *IMPULZ*[16] schemes.

These initiatives illustrate the diverse approaches taken across the network to foster more inclusive research environments and strengthen the participation of emerging talents.

Open access and data management practices

In line with frameworks introduced under Horizon 2020 and reinforced in Horizon Europe, the preparation of Data Management Plans (DMPs) has become a standard requirement. These plans typically address the collection, storage, ethical and legal considerations, and long-term availability of research data.

Complementing this, many RFOs also require or actively promote open access to peer-reviewed publications, ensuring that research findings are widely and rapidly disseminated. Publication costs are often eligible within project budgets, and additional guidance may be provided regarding repositories, licensing, or embargo periods. Together, these measures support a broader commitment to open science, transparency, and accessibility in quantum research.



[14] See: https://quantumdelta.nl/.
[15] See: https://saspro2.sav.sk/indexEn.html.
[16] See: https://impulz.sav.sk/en/programme.

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Public engagement and science education

- **Outreach and public events** – Engaging broader audiences in understanding quantum science is an important part of responsible research practice. Across the QuantERA network, many RFOs have supported a variety of initiatives to communicate quantum technologies to the public. For example, CNR (Italy) actively contributes to the "Italian Quantum Weeks"[17] initiative, which includes interactive demonstrations on quantum mechanics, computing, and cryptography for students and the public. LZP (Latvia) places strong emphasis on public communication through mainstream media channels.
- **Skills and training programmes** – Funders also play a role in building long-term capacity and raising awareness through education. In the United Kingdom, **UKRI** supports a range of activities including the *Quantum Technologies Fellowships* [18], training schemes hosted by the *National Physical Laboratory (NPL)*, *Quantum Technology Summer Schools*, and the outreach-oriented *Quantum City* initiative aimed at schools and the public.

These programmes illustrate how funding organisations can combine research support with public dialogue and talent development in emerging technological fields.

Key RRI Practices among QuantERA Funding Agencies

- ☑ Implementation of Gender Equality Plans
- ☑ Promotion of Gender Balance by encouraging research teams, integrating gender balance into evaluation processes, awareness-raising communication
- ☑ Balanced Evaluation Procedures
- ☑ Support for Early-Career Researchers
- ☑ Open Access Policies
- ☑ Implementations of Data Management Plans
- ☑ Public Engagement and Science Education
- ☑ Research Integrity Frameworks

Research integrity

- **Codes of conduct and integrity frameworks** – Many RFOs refer to national or institutional frameworks to safeguard good research practices and ensure ethical compliance. For example, **DFG** (Germany) requires that beneficiary institutions implement its *Code of Conduct for Safeguarding Good Research Practice*[19] as a funding condition. **NWO** (Netherlands) operates in alignment with the *Netherlands Code of Conduct for Research Integrity*[20].
- **RRI frameworks and secure collaboration** – Some RFOs have developed or promoted structured frameworks to support anticipatory and inclusive research governance. **UKRI** (United Kingdom) encourages researchers to apply the *Anticipate, Reflect, Engage, Act (AREA)* framework as part of their approach to RRI[21]. Additionally, the *Trusted Research*[22] initiative helps institutions manage risks related to international collaboration in sensitive domains such as quantum technologies.

[17] See: https://www.isasi.cnr.it/en/category/outreach/iqws_en/.
[18] See: https://www.ukri.org/opportunity/epsrc-quantum-technologies-career-acceleration-fellowships/.
[19] DFG, Guidelines for Safeguarding Good Research Practice. Code of Conduct (revised version 1.2), 2025.
[20] NWO, *Netherlands Code of Conduct for Research Integrity*, 2018.
[21] Stilgoe, J., Owen, R., & Macnaghten, P., *Developing a framework for responsible innovation*, Research Policy, 42(9), 2013, pp. 1568-1580.
[22] See: https://www.ukri.org/manage-your-award/good-research-resource-hub/trusted-research-and-innovation/.

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RRI-Related Procedures in QuantERA Joint Calls

Between 2017 and 2023, QuantERA progressively refined the design and evaluation procedures of its joint transnational Calls to better align with the principles of RRI, especially in terms of inclusiveness and gender equality. While early Calls promoted fairness and transparency in general terms, later iterations introduced structured frameworks — including inclusive prioritisation criteria, dedicated training for panel members, and guidelines on gender-sensitive peer review.

These mechanisms were embedded at the level of **proposal submission, evaluation panel formation, and project selection** — shaping how research consortia designed their applications and how they were assessed. The goal was not only to promote excellence, but to ensure it is pursued in ways that are equitable, responsible, and consistent values promoted by the European Commission.

The comparative table below summarises the evolution of these mechanisms across four QuantERA I and QuantERA II joint Calls (2017–2023), based exclusively on the official *Procedures of the Call* and *Evaluation Panel Functioning* documents.

Table 1: Evolution of RRI mechanisms in QuantERA Calls (2017–2023)

Mechanism	Call 2017 (QuantERA I)	Call 2019 (QuantERA I)	Call 2021 (QuantERA II)	Call 2023 (QuantERA II)
Gender balance in Evaluation Panels	CSC encouraged gender balance in EP composition; not formalised.	Encouraged geographical, thematic, gender, and career-stage balance in EP; non-binding.	Gender balance actively promoted via Gender Equality Statement[23]; encouraged in panel formation.	Gender balance actively promoted via Gender Equality Statement, monitored and implemented in panel formation.
Early-career expert participation in Evaluation Panels (EP)	No reference.	Explicit encouragement of excellent young experts.	Encouraged.	Maintained encouragement.
Training & briefings for Evaluation Panel members	No training or briefing mechanisms described.	Briefing webinars introduced for external reviewers (not EP members).	Briefing webinars introduced for external reviewers (not EP members); Mandatory webinars for EP members: ethics, confidentiality, unconscious bias.	Expanded webinar briefings: methodology, expert selection, gender-sensitive review.

[23] See p.15 and Annex I.

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Use of gender balance as assessment/ prioritisation criterion during the evaluation process	Not mentioned.	Not mentioned.	Projects demonstrating better gender balance within research teams are prioritised in case of an ex-aequo ranking.	Gender balance is explicitly embedded in the prioritisation framework and applied when ranking ex-aequo proposals.
Inclusive communication in Call Documents	Not addressed.	Not addressed.	Inclusive, non-stereotypical language used in Call Documents and encouraged in briefings for evaluators.	Inclusive, non-stereotypical language used in Call Documents and encouraged in briefings for evaluators.

In the Call 2021, QuantERA introduced for the first time **the *QuantERA Gender Equality Statement***: *Towards a More Gender-Balanced Research in Quantum Technologies* (see next section for details). The Call 2023 included a formal requirement to foster Responsible Research and Innovation approaches in quantum research, supported by a shortened version of the RRI Guidelines[24]. Furthermore, open access publishing is strongly encouraged for Projects funded under both Calls.

These practices are being continued and further developed in QuantERA III. The **Call 2025,** launched in September 2025, strengthens the operationalisation of RRI values by introducing set of mechanisms to ensure that these principles are translated into practice:

- **Project consortia formation principles** highlight **gender balance** and **academic age balance**, encouraging the participation of female researchers and promoting inter-generational knowledge transfer through the involvement of postdoctoral and PhD researchers;

- Under **excellence** criterium, applicants (especially in the Quantum Phenomena and Resources (QPR)) topic are required to consider the gender dimension in research content, alongside the soundness of methodology, interdisciplinarity, and quality of open science practices;

- **Evaluation panel formation** continues to promote diversity and gender balance among evaluators, with gender-sensitive peer review guidelines provided to experts;

- The **selection** process applies a multi-step prioritisation mechanism that explicitly includes gender distribution among PIs and co-PIs, with the aim of achieving the most balanced overall outcome across all funded Projects. It also promotes participation of Widening countries;

[24] QuantERA, *Call 2023 for Transnational Research Proposals*.

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- The **management of funded Projects** is required to follow the *European Charter for Researchers* and *Code of Conduct for the Recruitment and Researchers*[25], while paying particular attention to gender balance at PhD and early-career levels;

- **Open science obligations** are encouraged through requirements for Open Access publishing, FAIR-compliant data management, and repository archiving, in line with Horizon Europe principles;

- One of the **expected impacts** of the Programme is progress towards a gender diverse and inclusive quantum community.

To consolidate these measures, **two revised annexes** were published together with the Call:

- **Annex 2: QuantERA Gender Equality Statement** – setting out the Consortium's commitment to a more gender-balanced quantum community, highlighting systemic barriers, and encouraging proactive measures at institutional and Project levels.

- **Annex 3: QuantERA Guidelines for Responsible Research and Innovation (RRI)** – offering a practical framework for embedding RRI in funded Projects, with concrete recommendations on open science, ethics, public engagement, gender, and science education.

Taken together, these provisions indicate that QuantERA III seeks to play an active role in advancing change within the quantum research community, aligning its practices with the European Commission's Gender Equality Strategy 2020–2025 and with Horizon Europe's framework for responsible, inclusive, and sustainable research.

Monitoring the Responsible Impact

Progress in implementing RRI measures is tracked through mid-term and final monitoring reports submitted by the QuantERA Projects, which gather information on open access, gender actions, and public outreach. In addition to written reporting, RRI implementation must also be demonstrated during *oral evaluation*, notably through presentations given by Projects at recurring QuantERA conferences.

Evidence of how Projects funded under QuantERA II put RRI principles into practice can be found in the *Report from Project Mid-term Review* (deliverable 4.3), which summarises the progress of Projects funded under the Call 2021[26]. Projects reported extensively on actions promoting **Open Science principles**. Nearly all of 39 Projects indicated that they make their (pre-print) publications available via **Arxiv**, which appears to be standard practice. Additionally, almost all Projects published articles in **open-access journals**. Several teams also shared data and software linked to their research outputs, making these accessible through platforms such as the **Zenodo repository**. These practices demonstrate QuantERA's strong impact on fostering transparency and accessibility in research.

Across the 39 Projects, a total of 690 researchers are involved in the teams. Around half of the team members are senior researchers. However, early-stage researchers — including post-

[25] European Commission, *The European Charter for Researchers The Code of Conduct for the Recruitment of Researchers*, 2005.
[26] QuantERA, *Report from Project Mid-term Review*, 2024. At the time of preparing this document, Project reporting is still ongoing — with final reports for the Call 2021 and mid-term reports for the Call 2023 pending. As such, the mid-term review report from the Call 2021 remains the only available QuantERA II Project progress report at this stage. A comprehensive summary of these activities, including Call 2023, will be published in the QuantERA II Impact Assessment Report (Deliverable 4.5).

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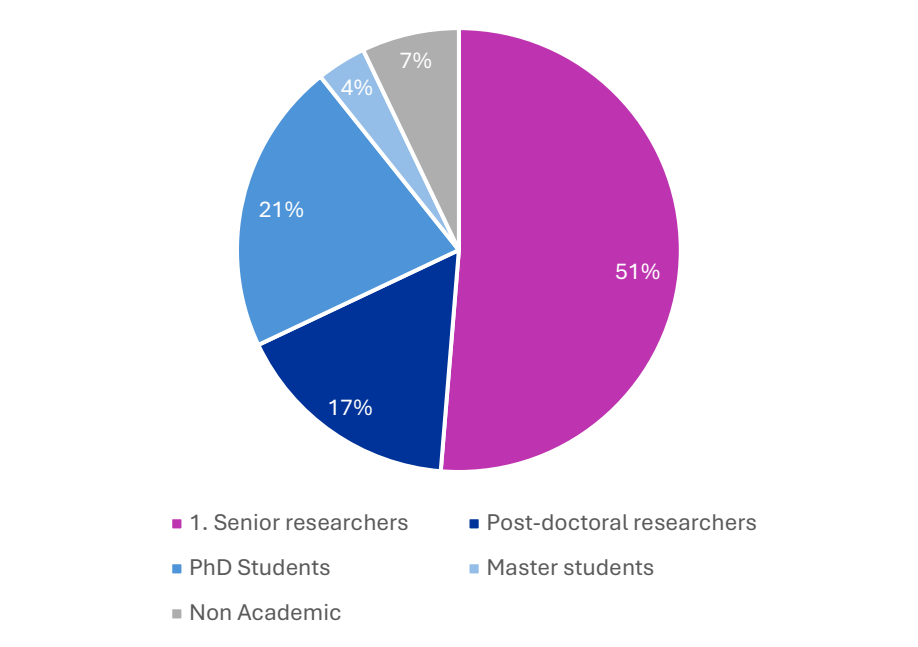
doctoral researchers, PhD students, and master students — also play an important role, making up 42% of all Project team members. QuantERA Projects seem to be a good framework for collaboration between senior researchers and early-stage researchers.

Figure 1: Distribution of Team Members by Career Stage



Projects were also asked to highlight their education and public engagement activities, focusing on impactful initiatives that foster societal benefits, transnational collaboration, and synergies with other European and international efforts.

In addition to conferences primarily targeting the scientific community, various activities were organized to engage audiences outside the scientific sphere. **For example, 51 (nearly one-third (31%) of all) activities were directed at civil society**, including presentations, workshops, and website publications. These efforts demonstrate the Projects' dedication to creating societal impact and promoting the dissemination of quantum technology knowledge. These initiatives show that RRI is already being practised — not only through top-down incentives, but often through the motivation and values of the research teams themselves[27]. Table below provides a detailed overview of these activities:

[27] The RRI-related achievements of all Projects funded under the Call 2021 are publicly available through their presentations, published on the QuantERA website as part of the materials from the 2022 Strategic Conference in Amsterdam.

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Table 2: Overview of education and public engagement activities reported by QuantERA Call 2021 Projects

Type of activity	Number
Presentations	32
Exhibitions	27
Workshops	22
Interviews	9
Web	4
Videos	4
Lab tour	2
Posters	2
Press releases	2
Media briefings	2
Articles published in the popular press	2
School for PhD students and postdocs	2
Lectures (24 hours) included in the MSc	2
Public engagement	1
Education of students	1
Flyers	1
Film⁄TV clips	1
PhD School	1
Seminar for master students	1
Quantum training laboratory	1
lecture at graduate student level	1
Open lab day	1
Total general	**121**

A comprehensive summary of activities undertaken during the entire implementation period by all Projects funded under Call 2021 and Call 2023 will be published in the QuantERA II Impact Assessment Report (Deliverable 4.5), as the Projects are still at too early a stage to provide final results.

Special Focus: Gender Equality

The strategic role of gender equality in the quantum ecosystem

The emphasis on gender equality in research is not a formal requirement — it is a strategic and systemic necessity. High-tech fields, including quantum science, remain deeply affected by gender imbalances at all levels: from early education to leadership roles in academia and industry[28]. This underrepresentation is not only a matter of fairness — it directly impacts the **quality, creativity and societal relevance** of quantum research.

[28] Numerous studies have addressed persistent gender imbalances in science and high-tech sectors. As one example, see: European Commission, *She Figures 2024: Gender in Research and Innovation – Statistics and Indicators*, 2025.

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Building inclusive quantum ecosystems is essential for several reasons:

Excellence and innovation: Diverse teams generate more robust, original and applicable research outcomes[29]. Excluding half of the talent pool limits Europe's scientific and technological capacity;

Ethical and democratic legitimacy: Publicly funded research should reflect and serve diverse societies. Representation shapes priorities, values and accessibility of emerging technologies;

Long-term sustainability: Addressing systemic inequalities in science is critical to building resilient, attractive and future-ready research cultures;

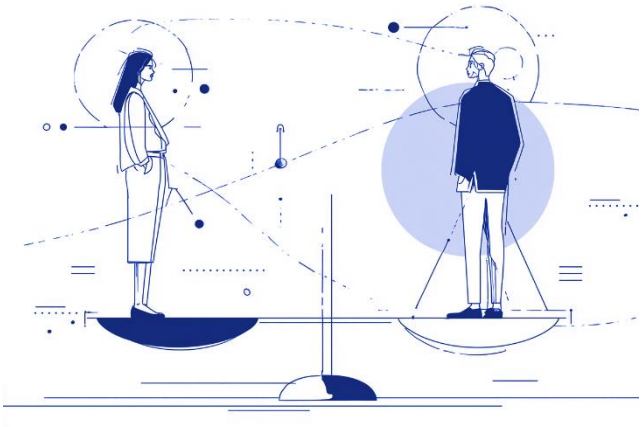
Alignment with EU values and Horizon Europe framework: The European Union has progressively strengthened its policy framework regarding gender equality and inclusiveness in research and innovation. Key priorities include the obligation for public and private R&I institutions to have Gender Equality Plans in place as a condition for funding eligibility, the consideration of gender balance as a ranking factor in proposal evaluation, and the integration of the gender dimension into the research content as part of the Excellence criterion.

As already outlined in the RRI general section above and further elaborated in this chapter, QuantERA II recognises the strategic role of gender equality by embedding it within its Programme logic and implementation through the following activities:

- Task 5.4 explicitly focuses on supporting more gender-balanced quantum research;
- Call texts and guidance documents have encouraged applicants to consider gender in team composition and Projects content. This aspect is also an important element of the evaluation process;
- Several RFOs have taken steps to include gender-related criteria in Projects evaluation at the national level or in the eligibility processes;
- Monitoring reports collect data on gender aspects of funded Projects, allowing for gradual development of indicators and benchmarks.

At the level of Projects implementation, examples of gender-responsive practices include:

- Efforts to ensure gender-diverse research teams;
- Outreach activities encouraging girls and young women to explore careers in quantum technologies;
- Reflexive attention to inclusion and internal communication styles within Project consortia.



[29] This has been confirmed by a broad body of research; see, for example: Jones, B. F., Wuchty, S., & Uzzi, B., Multi-university research teams: Shifting impact, geography, and stratification in science. Science, *322*(5905), 2008, pp. 1259–1262.; Nielsen, M. W., Alegria, S., Börjeson, L., Etzkowitz, H., Falk-Krzesinski, H. J., Joshi, A., Leahey, E., Smith-Doerr, L., Woolley, A. W., & Schiebinger, L. Gender diversity leads to better science. Proceedings of the National Academy of Sciences, 114(8), 2017, pp.1740–1742; AlShebli, B. K., Rahwan, T., & Woon, W. L. The preeminence of ethnic diversity in scientific collaboration. Nature Communications, *9*(1), 2018, p. 5163.

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These actions, while still evolving, demonstrate growing awareness among both funders and researchers that **gender equality is not a side issue**, but an essential dimension of responsible research.

Understanding Concepts

Given the diversity of concepts related to gender equality in the EC framework, and to avoid potential misunderstandings, the Consortium agreed at the beginning of Task 5.4 to adopt a consistent use of the terms "gender equality/gender balance". Indeed, sister projects on gender in R&I have identified and addressed the traditional confusion between gender balance and the gender dimension. While gender balance refers to women's fair representation among researchers involved in proposals or in decision-making, the gender dimension in R&I content refers to the use of sex and/or gender analysis – when appropriate – in all phases of a research and innovation project.

In order to help the Consortium clarify and embrace the key concepts related to gender equality in their daily work, Task 5.4 leader took the opportunity to explain the meaning and aim of "gender balance" as one of the key objectives, but not the only one, of the EC framework for gender equality in R&I. **Internal communication on "gender balance" topics was used as an awareness-raising activity and an opportunity to spread the message within the Consortium, as follows**:

WHAT DO WE MEAN BY GENDER BALANCE?

When the QUANTERA II Call documents and also the agreed QUANTERA II Gender equality statement refer to a fair representation (read gender balance), we mean that the goal is to have more women participating in the quantum field.

The goal of gender balance is neither an imposition of a concrete number of women and men, nor an obstacle for research Projects with more women. For instance, the Spanish Law on Gender Equality established that a composition tends to the gender balance when there is a 40-60% representation of either sex. This is only indicative and useful to identify gender segregation based on historical gender discrimination.

In this sense, there is enough evidence for the physics field that the underrepresented group has historically been women. The aim of this measure called "gender balance" is to address this unfair representation. Please consider that we could not use gender equality measures such as gender balance to prevent women from participating in any field because this would go against the spirit of the measure.

One of the renewed commitments of the European Commission for Horizon Europe is to get gender balance in the research teams, careers and decision-making: Particular attention will be paid to ensuring gender balance in evaluation panels and in other relevant advisory bodies, such as boards and expert groups. Gender balance among researchers involved in Projects will be strongly encouraged and will be taken into account for equally ranked proposals.

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Since the beginning of QuantERA II, the EC framework for gender equality in R&I has been evolving towards a more complex one. The European Strategy for Gender Equality 2020-2025 already introduced sensitivity to intersectionality as a cross-cutting principle of all EU policies and the ERA Policy Agenda 2022-2024[30] embraced inclusiveness as a new priority element of ERA Action 5. The term "Intersectionality", according to the GENDERACTIONplus initiative, supporting inclusive gender equality in the ERA[31], describes "overlapping or intersecting categories such as gender, sex, ethnicity, age, socioeconomic status, sexual orientation and geographical location that combine to inform individuals' identities and experiences"[32]. Moreover, ERA Policy Agenda 2025-2027[33] established gender equality as a structural policy in R&I systems: "Strengthening gender equality and inclusiveness in the ERA, notably with an intersectional approach".

The following table outlines the shift in the ERA Policy Agenda from 2022–2024 to 2025–2027 in addressing gender equality and inclusiveness:

Table 3: Changes in the ERA Policy Agenda from 2022–2024 to 2025–2027 regarding gender equality and inclusiveness

ERA Policy Agenda 2022-2024	ERA Policy Agenda 2025-2027
Action 5. Promote gender equality and foster inclusiveness, taking note of the Ljubljana Declaration	Structural policy: Strengthening gender equality and inclusiveness in the ERA, notably with an intersectional approach
Gender equality is a core EU value and gender mainstreaming a core EU strategy […] For gender equality the new ERA means most notably the development of inclusive gender equality plans with Member States and stakeholders, building on Horizon Europe. This inclusiveness dimension aims to better tackle intersectionality, i.e. intersections between gender and other diversity categories, as well as to take into account inclusiveness at the geographical and sectorial levels to ensure that all countries are on board and that the innovation and private sectors are also involved. The Ljubljana Declaration defines priority areas of common action to promote gender equality and inclusiveness in the new ERA. The four outcomes proposed reflect the key priorities: • *Develop a policy coordination mechanism to support all aspects of gender equality through inclusive Gender Equality Plans and policies, and a dedicated EU network on their implementation* • *Strategy to counteract gender-based violence including sexual harassment in the European R&I system and to assure gender equal and inclusive working environments through institutional change in any research funding or performing organisation*	*Achieving gender equality, equal opportunities, and inclusiveness—along with integrating the gender dimension into research and innovation (R&I) content—requires a structural approach. This means transforming the entire European R&I system. Such structural change can only happen through the shared commitment of R&I organisations, their funders, national authorities, and the European Commission. An ERA Forum sub-group on Inclusive Gender Equality in the European Research Area will support the achievement of the following outcomes between 2025-2027:* • *devise a monitoring and evaluation approach for effective implementation of inclusive GEPs;* • *develop guidelines for implementing an intersectional approach in R&I policy, including in the collection, selection and analysis of indicators;* • *design a monitoring and evaluation approach increasing the uptake of the integration of the gender dimension in R&I content;* • *enhanced gender mainstreaming mechanism for synergies with other ERA actions at the EU and national level;*

[30] European Commission, *European Research Area Policy Agenda. Overview of actions for the period 2022-2024*, 2021.
[31] See: https://genderaction.eu.
[32] GENDERACTIONplus, Glossary, 2024.
[33] European Commission, ERA Policy Agenda 2025-2027, 2025.

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• *A policy approach to inclusive gender equality, that addresses gender mainstreaming and opening to intersectionality with other diversity dimensions to advance the new ERA* • *Develop principles for the integration and evaluation of the gender dimension in R&I content in cooperation with national Research Funding Organisation*	• *implement the Code of Conduct on gender-based violence in R&I developed by Action 5 of the ERA Policy Agenda 2022-2024;* • *principles developed for gender budgeting and expenditures tracking in R&I.*

QuantERA develops activities under the ERA framework and contributes to their policy priorities and outcomes, including gender equality and inclusiveness.[34] Although the Quantum field does not address, in principle, sex/gender analysis in the content of R&I, efforts to explain, differentiate and identify all concepts can help to avoid misuse and are consistent with QuantERA's activities in this area.

Lines of Action towards Gender Inclusiveness

Measures in Research Calls

Over the years, QuantERA has been gradually introducing dedicated mechanisms to foster gender balance within its Calls. In line with the intensified efforts towards gender balance, the Call 2021 introduced a new element: a 'declaration' calling for action and targeting applicants and their institutions. This **Gender Equality statement,** recognised as a promising practice by the GENDERACTIONplus[35],set the framework for gender equality at both institutional and Project level and provided visibility to the role of gender equality in QuantERA II (see Annex 1). This Statement was issued by the QuantERA II Call Steering Committee as an annex to the Call 2021 documentation. It was a common, non-modifiable text, formally adopted at programme level and addressed to all applicants and their institutions as a guiding framework. While suggesting that the promotion of STEM vocations free from gender stereotypes should start at the level of schools, the funders supporters of the statement recognized also the impact their actions can have on the quantum field.

From 2021 onwards, QuantERA II Calls have added new and diverse measures to ensure a more balanced Quantum field and to encourage funded Projects to develop their own actions on gender equality to spread the message and have an impact on the field, as follows:

Table 4: Gender equality mechanisms introduced in QuantERA Calls 2017–2023

	Call 2017[36] Call 2019[37]	Call 2021[38]	Call 2023[39]
Recommendations on gender equality at funded Project level	• *The Project must bear in mind gender issues and promote equal*	• *The Project should bear in mind gender balance and promote equal opportunities between women and*	• *The Project should bear in mind gender balance, especially at the PhD level and early-career*

[34] European Commision, *Framework for the integration and evaluation of inclusive gender analysis in research and innovation content*, 2024.
[35] GENDERACTIONplus, *How to promote gender in partnerships?* , GENDERACTION Policy Brief, 16, April 2021, p. 3-4.
[36] QuantERA, Call 2017.
[37] QuantERA, Call 2019.
[38] QuantERA. Call 2021.
[39] QuantERA, Call 2023.

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	opportunities between women and men at all levels in the implementation of the research activities	*men at all levels in the implementation of the research activities.*	*opportunities resulting from the funded Projects, and promote equal opportunities between women and men at all levels in the implementation of the research activities.*
Gender Equality Statement		• *Annex 2. QuantERA II Gender Equality Statement*	• *Annex 2. QuantERA Gender Equality Statement*
Recommendations on Evaluation Panels Functioning		• *With the aim of providing as much diversity as possible to the scientific evaluation, gender balance will be considered in the panel formation.*	• *With the aim of providing as much diversity as possible to the scientific evaluation, gender balance will be actively promoted in the panel formation.*
Gender balance promotion		• *To promote equal opportunity and gender balance, QuantERA II encourages the participation of consortia with a fair representation of female researchers both as PIs and in the research team.*	• *To promote equal opportunity and gender balance, QuantERA II encourages the participation of consortia with a fair representation of female researchers as PCs, PIs and in the research team.*
Criteria in Evaluation Process		• *The proposals demonstrating a fair gender representation and involving partners from the widening countries in their consortium should be prioritised*	• *The gender balance among the personnel named in the application who will be primarily responsible for carrying out the research and/or innovation activities will be used as a factor for prioritisation.*
Expected impacts			• *Move towards a gender diverse and inclusive quantum community, in particular targeting PhD students and early-career researchers;* • *Provide equal opportunities for researchers of all genders*

There has been a qualitative leap from the Call 2019 to the Call 2021 once the advice from Task 5.4. was provided. While the 2017 and 2019 Calls only considered the encouragement of funded Projects to conduct activities on gender equality, the Call 2021 expanded this recommendation to include measures at different levels (evaluation panels, ranking criteria…) as commitments by the QuantERA Consortium. These measures were consolidated in the following Call 2023, becoming part of the organisational culture of QuantERA. The Call 2025, launched in September 2025, includes new, updated Gender Equality Statement as an annex,

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among other measures to promote gender equality. It explicitly encourages applicants to consider gender balance when building research consortia and sets the expectation that funded Projects contribute to 'moving towards a gender diverse and inclusive quantum community, in particular targeting PhD students and early-career researchers'.[40]

Training for the Evaluation Purpose

Through its activities, QuantERA has been actively sharing guidelines and training opportunities to strengthen awareness and good practices among its members.

In the framework of its Calls for proposals, QuantERA developed in mid-May 2021 **guidelines for a gender-sensitive peer review** to support the evaluation panel, and the content was presented during the QuantERA II *infoday* for that Call 2021. The guidelines acknowledged the fact that gender biases are not exclusive to men and provided three main reasons to ensure gender-balanced evaluation panels:

- *The diversity of ideas and backgrounds, as in the research teams, is positive to make the best decisions*
- *Access to the evaluation systems and related-networks is positive for women's careers*
- *It is necessary to give more visibility to women as participants of the system in QT.*

The recommendations for gender-sensitive peer review stressed the idea that all people have different biases, and the evaluators should do their best to recognise them and take measures to neutralise them. This practice was continued in the following Calls.

Practical guidance for reviewers of QUANTERA II Calls for proposals:

- Pay attention to the dynamics that arise in the evaluation panel to ensure that all the members participate equally and informal information do not interfere in the discussions.
- The chair of the panel should encourage all members to challenge unconscious bias.
- Dedicate enough time for the evaluation. Biases arise more easily when we make snap judgements.
- Avoid assessments based on vague and subjective criteria. The evaluation criteria, including gender indicators, should be clear beforehand and equally applied.

As part of the collaboration with the EDI Working Group of the Quantum Flagship[41], the QuantERA Coordination Team shared with the members of the QuantERA II Consortium the **training opportunities on unconscious bias.**

[40] QuantERA Call 2025.
[41] See: https://qt.eu/working-groups/equity-diversity-and-inclusion.

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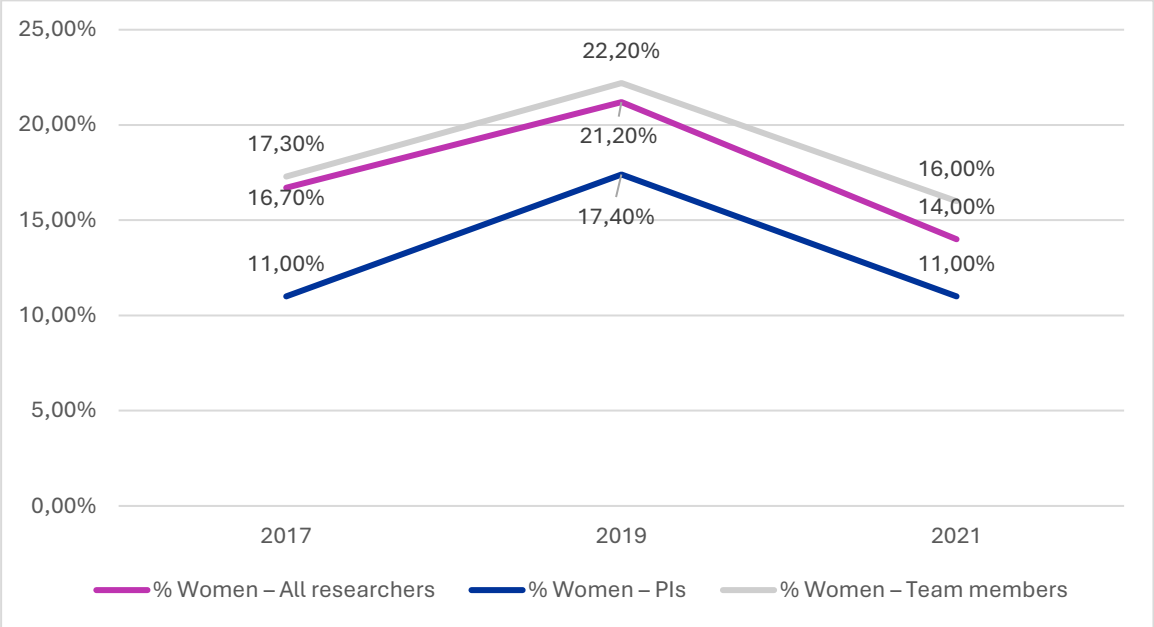
Monitoring Gender Balance

Data from the 2017–2021 Calls show fluctuations rather than a steady trend in women's participation. The highest share was recorded in 2019, when women exceeded one fifth of all researchers. In both 2017 and 2021 their overall presence was lower, around 14–17%. Across all three Calls, the proportion of female PIs remained consistently below that of female team members.

Figure 3: Women's participation in QuantERA Calls (2017–2021)



These percentages are aligned with the average representation of women researchers in the physics field in Europe. There is no growing or decreasing trend in terms of women's representation in these three Calls. Yet it can be claimed that the percentage of women PIs is systematically lower compared to team member representation.

Regarding Call 2023, the dataset is not yet complete due to the early stage of Project implementation, which occurs prior to reporting. However, the diagram below shows the general involvement of women in coordinating the Projects, which is about 20%, distributed almost equally between the roles of Project Coordinators and Principal Investigators (20,8% for PCs and 18,9% for PIs):

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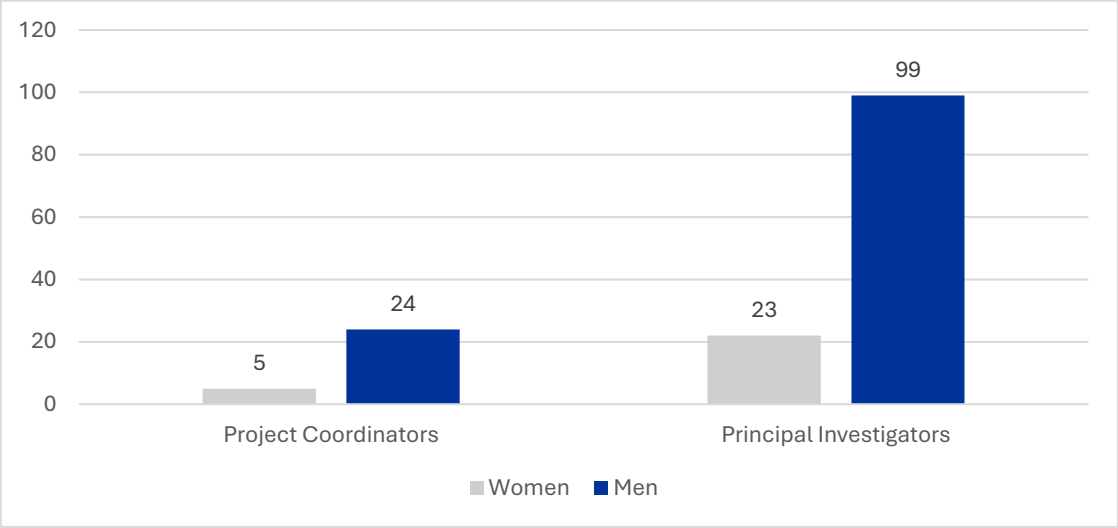
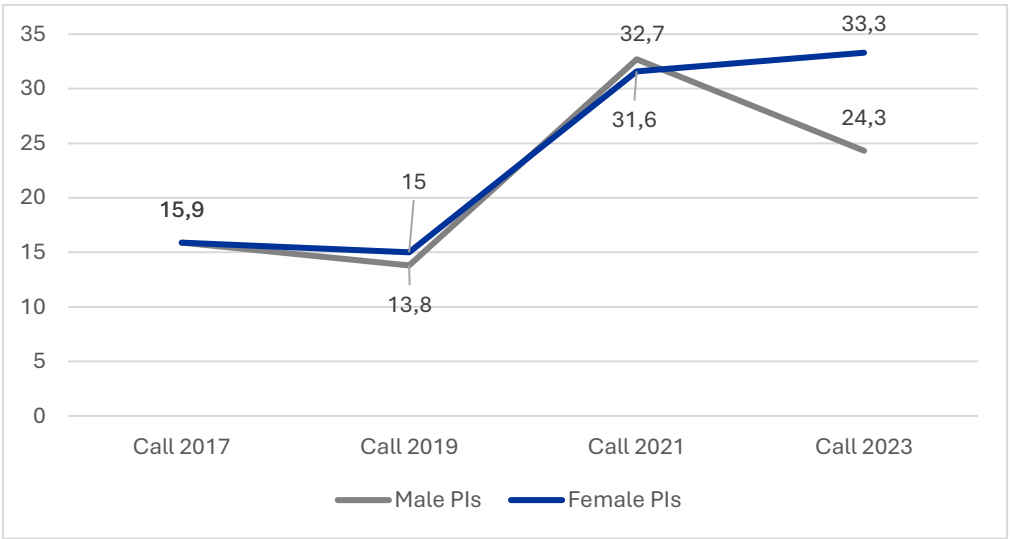
Figure 4: Gender representation among Project Coordinators and Principal Investigators in QuantERA II Call 2023 funded Projects



The data indicate a positive trend: women are increasingly successful in QuantERA Calls. While in 2017 and 2019 success rates were almost identical for women and men, and Call 2021 again showed comparable results, by 2023 the share of successful female applicants (33.3%) exceeded that of men (24.3%). This points to a growing visibility and competitiveness of women researchers in the Programme.

Figure 5: Success rate of female and male Principal Investigators (%) across all QuantERA Calls



An analysis of female Principal Investigators across the two QuantERA II thematic strands of QuantERA – **Applied Quantum Science (AQS)** and **Quantum Phenomena and Resources (QPR)** – reveals distinct patterns. Women submit more proposals in QPR, indicating a strong engagement with fundamental research, yet **their success rates are consistently higher in AQS**. In Call 2021, women reached a success rate of 38.5% in AQS compared to 27.1% in QPR, and in Call 2023 the difference persisted (31.2% vs 26.1%). This suggests that while

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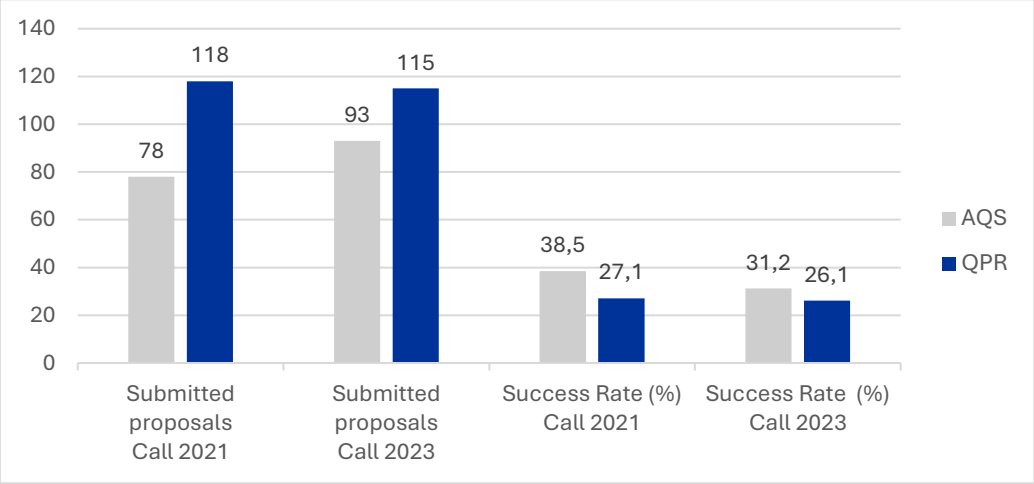
women are active in both domains, they are particularly effective in leading projects within the application-oriented AQS strand, where their leadership translates into higher competitiveness and funding success.

Figure 6: Submitted proposals and success rates of female Principal Investigators in QuantERA II Joint Calls by call topic (AQS and QPR)



"Encouraging the QuantERA-funded Projects to engage into activities targeting the gender equality objectives defined for QT" was one of the priorities of Task 5.4. As a result of the QuantERA II Call 2021, 39 research Projects were funded and have already passed a monitoring evaluation. The vast majority of Projects - 30 of them – developed **activities aimed at promoting women in the quantum field** with a balanced mix of actions focused on the internal structures of the Project and on external agents. The target audience of these activities are young women students/researchers in most cases, but also members of the consortium, the scientific community and even the general public with interest in quantum sciences and technologies in some cases. The type of activities ranges from internships for women students, recruitment practices, requirement of Gender Equality Plans at institutional level to promotional and communication activities supporting a more-balanced quantum field (presentations, lab tours, international days…).

Moreover, two initiatives carried out by the funded Projects from the Call 2021 ConSpiQuOS and CVSTAR Projects are outstanding:

- **Blog series by Quantum Machines**: Women Pushing the Limits of Quantum Computing/Frontiers, carried out by the Controlling Spins in Quantum systems in an Online Setting **(ConSpiQuOS)** Project*: "As part of Quantum Machines' blog posts following the latest news in quantum technologies, a series of so far 7 blogs have focused on how women are breaking new ground in quantum computing and beyond. Each of these posts include interviews with women in quantum science, ranging from PhDs to Professors. One of these posts is an interview with Anasua Chatterjee (PI of partner 2 in the ConSpiQuOS Project)."*[42]

- **Womanium Information session**/ Q&A for prospective students to learn more about pursuing a PhD, carried out by Continuous-Variable Multi-User Quantum Key Distribution for 5G and distributed storage applications (**CVSTAR**) Project*: "One goal for womanium quantum is to provide greater visibility and recognition for underrepresented female researchers in this field of science. At the event PhD students*

[42] See: https://www.quantum-machines.co/blog/.

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shared the content of their work and and how their life as a PhD student is. Having female PhDs/PhDs students answering questions help engage potential female students who feel more related."

Visibility of Women Leaders in Quantum

Task 5.4 identified a crucial need to increase women's visibility in the quantum field. In response, FECYT launched the 'Women Leaders in Quantum' interview series, announced in July 2022 on the QuantERA website. The series featured women coordinators of Projects funded under the 2017, 2019, and 2021 Calls. By portraying their scientific achievements and personal experiences, the initiative aimed to provide role models and foster a more inclusive image of QT. The interviews pursued the following aims:

Highlight the presence of women researchers among the Coordinators of the QuantERA-funded Projects in QuantERA;

- Encourage the QuantERA Projects consortia to target the gender equality objectives defined for QT;
- Explore the optimal work-life balance and gender equality measures for QuantERA activities;
- Promote STEM vocations free from gender bias among women students.

For this purpose, 5 coordinators of funded Projects were selected for this activity and accepted to be part of it and share their experiences: Yiwen Chu,[43] Zala Lenarcic,[44] Costanza Toninelli,[45] Milena D'Angelo,[46] and Marzena Szymanska.[47] The content of the interviews combined questions related to the sources of inspiration for choosing quantum technologies, Project's impacts on technology and society, the role of leadership and gender balance.

[43] QuantERA, Women leaders in quantum – YIWEN CHU, the Coordinator of the MQSens Project.
[44] QuantERA, Women leaders in quantum – ZALA LENARČIČ, the Coordinator of the QuSiED Project .
[45] QuantERA, Women leaders in quantum – COSTANZA TONINELLI, the Coordinator of the ORQUID Project.
[46] QuantERA, Women leaders in quantum – MILENA D'ANGELO, the Coordinator of the Qu3D Project.
[47] QuantERA, Women leaders in quantum – MARZENA SZYMANSKA, the Coordinator of the Interpol Project.

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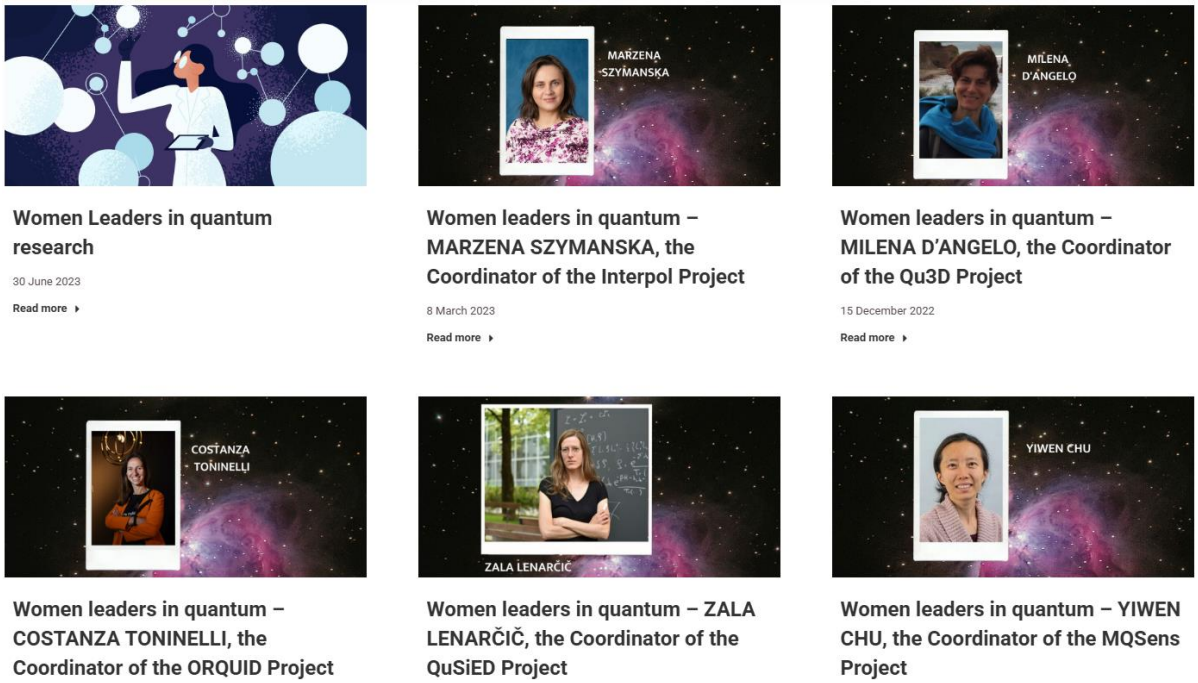
Figure 7: Screen from the 'Women Leaders in Quantum' interview series published on the QuantERA website



Identification of Challenges and Barriers Faced by Women Pursuing Career in QT

Based on the quantitative and qualitative data collected during the interviews, as well as the lessons learned during the process, Task 5.4 leader carried out an analysis of the main problems identified within the Quantum field to achieve gender equality. Women's voices were used as a privileged material and valuable perspective for shaping effective actions. The interviews, completed under Task 5.4, made it possible to identify a number of obstacles that hinder gender balance in the field. Raising awareness of all actors in the system about these barriers is considered a key step towards addressing persistent inequalities and enabling structural solutions.

While leadership roles were generally perceived as meaningful and rewarding challenges, the interviews also highlighted a number of persistent barriers to gender balance embedded in the organisational culture of R&I institutions and physics departments. A detailed analysis of these barriers is presented in *Navigating the Quantum Field: Women Leaders' Views* (Annex III). Importantly, the findings of these interviews are not an end in themselves but are intended to inform future actions at programme and institutional levels, ensuring that awareness of these challenges translates into concrete measures to foster a more inclusive quantum research environment.

Synergies and Networks

The Quantum Flagship EDI Working Group

Since 2022, Task 5.4 leader has been taking part in the monthly meetings of the The Quantum Flagship EDI Working Group (EDI WG)[48] representing QuantERA II in their discussions and actions for the quantum field. The aim of involving QuantERA II in the EDI WG was to facilitate the coordination of the activities for the Quantum ecosystem and joining forces. Task 5.4 leader

[48] See: https://qt.eu/working-groups/equity-diversity-and-inclusion.

has participated in more than 20 meetings throughout the lifetime of the Task. Thanks to the participation in this WG, QuantERA II is better aligned and able to create synergies in the promotion of Task 5.4 objectives. This has been one of the main achievements of Task 5.4. and a clear recommendation for the future modality of work in gender and inclusiveness.

The data collected periodically by the Quantum Flagship EDI Working Group through anonymous surveys on organizational culture have been showing that discrimination based on gender is still prevalent in physics institutes and RPOs. Moreover, the lack of reference models and visibility of women leaders have been also part of the concerns for the QuantERA Consortium.

Additionally, in the context of the QuantERA liaison with the Quantum Flagship, reference can be made to collaboration around gender-related communication efforts — in particular, the joint dissemination activities in social media campaigns such as **#QuantumEquilibrium**, which aimed at **shedding light on gender equality in the world of quantum technologies**[49].

Sister projects: GENDERACTIONplus

Task 5.4. leader has facilitated the contact between the Quantum Flagship EDI Working Group (EDI WG) and GENDERACTIONplus coordinator, who has been invited to participate in one of the monthly meetings of the EDI Working Group to present GENDERACTIONplus and discuss potential actions for the Quantum field with the EDI WG members. The coordinator ISAS (CZ) presented GENDERACTIONplus to the EDI Quantum Flagship WG and discussed continued challenges and policy needs in relation to inclusive gender equality in the ERA on the 11th of March, 2024.

Communication and Dissemination

In relation to implementing the Task 5.4, the QuantERA coordination team opened a dedicated space in the QuantERA website with the aim of promoting all the activities and news related to gender equality.[50] This has been the space in which a series of interviews with QuantERA Project coordinators was disseminated. Moreover, other internal communication activities have spread the word of a "gender-balanced quantum field", such as the clarification of concepts "What do we mean by gender balance" mentioned above and the invitations to training activities. In addition, gender-related initiatives, both from QuantERA and the Flagship, have been disseminated through the Programme's social media channels.

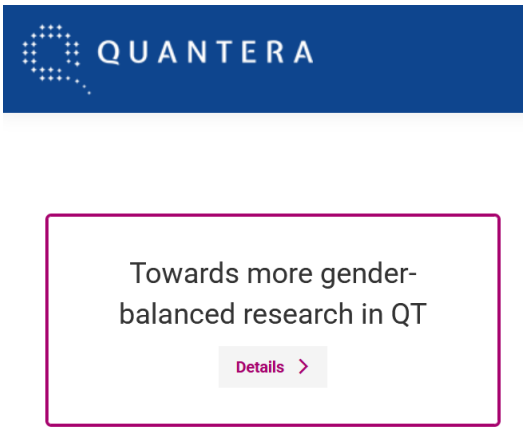


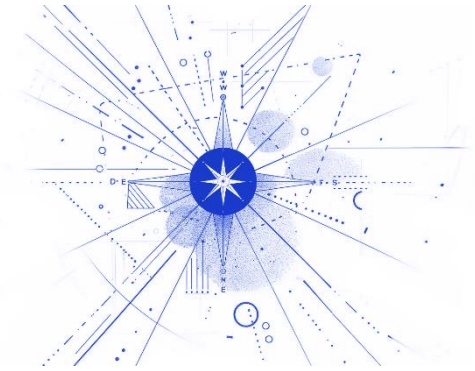
Figure 8: QuantERA website section on gender balance

Gender balance is promoted and communicated also through other activities implemented by the network. For instance, women's representation is encouraged in every funded Project presentation during Programme conferences, as well as among speakers at quantum-related events. These measures are low in resource and complexity requirements, yet they effectively convey the message that a diverse and inclusive field is being built.

[49] See: https://www.youtube.com/playlist?list=PL52eYZ21uXgbtHwtDqBu9uuwedK6qf7Rp.
[50] QuantERA, *Towards more gender-balanced research in QT*.

General Conclusion: Towards a More Responsible and Inclusive Quantum Innovation

The QuantERA II experience has confirmed that RRI in quantum science is not a set of abstract principles, but a practical framework that must be integrated into research governance, programme design, and Project implementation. The following guidelines summarise lessons learned, updating the 2018 document and providing a roadmap for QuantERA III and beyond. They combine general recommendations for RRI in quantum science with specific measures on gender equality, formulated on the basis of Task 5.4 and the evidence collected from Projects, RFOs, and European initiatives.



Updated General Guidelines for RRI in Quantum Technologies

Compared to the 2018 version, RRI in quantum is now expected to be operationalised through measurable commitments. The updated framework emphasises:

- **Structural embedding of RRI**: RRI principles are to be integrated into programme design, funding schemes, and Project implementation as part of mainstream research governance.
- **Open science with secure governance**: Research outputs (publications, data, software) should be made openly accessible while ensuring responsible handling of sensitive information relevant to security and technological sovereignty.
- **Ethical anticipation and reflexivity**: Quantum research should systematically address its potential social, ethical, and security implications, fostering reflexivity at all stages of research and innovation.
- **Public engagement**: Engagement with non-academic stakeholders and civil society should be strengthened, framing quantum technologies as a societal endeavour rather than a purely technical domain.
- **Support for early-career researchers**: Opportunities for PhD candidates and postdoctoral researchers should be promoted, with fair recognition of their contributions in collaborative Projects.
- **Synergies with ERA and EU initiatives**: Practices should be aligned with the ERA Policy Agenda, Sustainable Development Goals, and European initiatives such as the Quantum Flagship and GENDERACTIONplus to ensure coherence across research systems.

These priorities are aligned with the practical implementation guidelines provided as an attachment to the Call Announcement in each QuantERA Call since 2021 (see Annex II).

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Specific Guidelines on Gender Equality in Quantum Technologies

Particularly Gender equality in the Quantum field is by no means a finished task. To continue to promote gender equality in QuantERA III activities, Task 5.4. has collected **recommendations from the interviews with women Quantum leaders** targeting R&I institutions and physics departments:

Strengthen and expand incentives to create more gender balanced teams and consortia.

Consider parental leaves in Projects documents to avoid any penalty in the selection process and ultimately in the professional career.

Allocate budget for childcare and other care responsibilities during workshops and conferences.

Require participation in trainings on gender equality and prevention of abuse for all PCs and group leaders.

Build a gender-sensitive culture in quantum-related institutions and research groups as a shared responsibility that will benefit all genders in the field, including a family-friendly environment.

As a valuable summary, it is worth highlighting a fragment from the mid-term review submitted by one of the Projects funded under Call 2021, namely *SensExtreme:*

> *Learning and practising science should be accessible to everyone. This is our goal when recruiting and retaining students by integrating new members, regardless of their differences. They will join a team that already welcomes all curious minds and adopts best practices to promote equal opportunities. All teams involved in **SENSEXTREME** ensure to create a safe training environment that is conducive to open discussions among members and eliminates physical and societal barriers to equity, diversity and inclusion. This includes improving accessibility for all members, regardless of physical or learning difficulties, addressing obstacles, adapting instrumentation, operational methods, and schedules to accommodate individuals in our laboratory and provide high level training, recognizing the unique needs of each student [...]*

In addition to the recommendations gathered both from interviews with women quantum leaders and from the reporting, QuantERA recognises the need to formulate broader guidelines that apply at programme and institutional levels. These guidelines are intended to provide a framework for all stakeholders involved in quantum research – funding organisations, research institutions, and Project consortia – to ensure that gender equality is systematically embedded and sustained across the field.

- **Implementation of Gender Equality Plans**: All beneficiary institutions should have a valid and successfully implemented inclusive GEP as a condition for eligibility, in line with Horizon Europe requirements.

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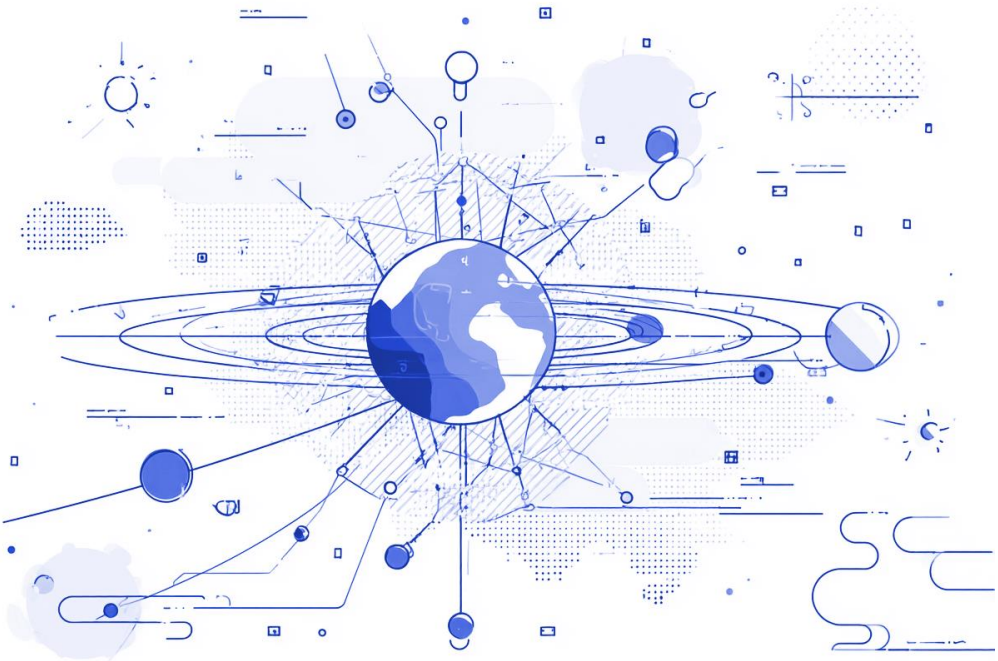
- **Balanced research consortia**: Gender balance should be encouraged not only among team members but also in leadership positions (Project Coordinators and Principal Investigators), with particular attention to PhD students and early-career researchers.
- **Monitoring success rates**: Gender-disaggregated data should be systematically collected and reported across all calls, covering both application numbers and success rates, to identify and address structural barriers.
- **Role models and visibility**: Women leaders in quantum research should be actively promoted in communication, outreach, and public engagement activities to inspire young researchers and students.
- **Zero tolerance for harassment**: Institutions and Projects should adopt and enforce clear policies against gender-based abuse.

These guidelines are reflected in the principles outlined in the QuantERA Gender Equality Statement attached to the Call Announcement in each QuantERA Call since 2021 (Annex I). The Statement emphasises the creation of gender-sensitive organisational cultures, equal opportunities at all levels, diversity as a strength for science, adequate career support for women PhDs, and the importance of role models in Quantum Technologies.

As this document shows, building a responsible and inclusive quantum ecosystem is not a finished task but an ongoing process. The lessons of QuantERA II provide a foundation for further action, ensuring that future programmes and institutions can embed responsibility, openness, and gender equality at the very heart of quantum research. **A lasting impact requires moving beyond individual initiatives towards structural, systemic change.** The quantum field is still young — and this is precisely what makes it a powerful opportunity to build inclusive cultures from the outset, not retroactively. As the field stands at the threshold of rapid transformation and growing strategic relevance, ensuring RRI principles is not only a question of fairness, but a foundation for resilience. A more sustainable, responsible and gender-balanced quantum ecosystem will be more creative, more just, and ultimately more effective in serving Europe's long-term societal and technological goals.



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Annex I. QuantERA II Call 2021 Gender Equality Statement

Annex 2: QuantERA II Gender Equality Statement

TOWARDS A MORE GENDER-BALANCED RESEARCH IN QUANTUM TECHNOLOGIES

Since its inception, the QuantERA II Consortium has been committed to addressing the gender imbalance in Quantum Technologies (QT) research and spreading the research excellence across the European Research Area (ERA). In order to move the gender balance issue into the spotlight, QuantERA II decided to improve the gender equality measures at both the consortium as well as the project level, thus becoming an active agent of the changes encouraged and promoted by the European Commission, research performing institutions and Research Funding Organisations, moving towards achieving gender equality in R&I across Europe.

Considering that:

- There is a particular imbalance in the STEM fields, 39% women among graduates at doctoral level, 35% at postdoctoral level, 28% at mid-career and 15% at senior level (*She Figures*, 2018[8]);

- The promotion of STEM vocations free from gender stereotypes should start at the level of schools, since this is a societal issue and constitutes a long-term objective;

But aware of the impact that our research funding organisations can have in the quantum field, we encourage physics institutes and departments as well as researchers in physics and in Quantum Technologies:

- To create a gender-sensitive environment and organisational culture in the physics field that promotes equal opportunities between women and men **at all levels**;

- To create an equality standard regarding the management structure of their organisations;

- To acknowledge that diversity is beneficial for science and strengthens the quality of science;

- To encourage all women PhDs in physics and in Quantum Technologies and provide them with the adequate career support services and fair chances in promotion process;

- To acquaint STEM students with role models of women researchers in Quantum Technologies;

And thus, help us to have a more gender-balanced research in Quantum Technologies in the coming years. The QuantERA II evaluation process will consider gender balance in the evaluation panels as much as possible and will provide gender-sensitive peer review guidelines for our evaluators. The success rates of this call will be monitored by the QuantERA consortium.

Please visit our **call for proposals** (link) and **join us in our desire to reinforce the participation of fairly composed consortia of researchers**.

The QuantERA Call 2021 Call Steering Committee

[8] https://ec.europa.eu/info/publications/she-figures-2018_en

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Annex II. QuantERA Guidelines for Responsible Research and Innovation (RRI)

Annex 3: QuantERA Guidelines for Responsible Research and Innovation (RRI)

The QuantERA consortium has developed a guideline for Responsible Research and Innovation (RRI) in proposals to QuantERA.

What is RRI?

Responsible Research and Innovation is an approach that anticipates and assesses potential implications and societal expectations regarding research and innovation, with the aim to foster the design of inclusive and sustainable research and innovation.

Responsible Research and Innovation implies that societal actors (researchers, citizens, policy makers, business, third sector organisations, etc.) work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of society.

RRI is a cross-cutting issue that is generally articulated around 5 main dimensions:

- public engagement
- open access
- gender
- ethics
- science education

RRI-Tools provides more information about RRI and examples of integration of its dimension in research.

QuantERA and RRI

Provided below is a non-exhaustive list of possible actions that can be put in place to make RRI and integral part of your research. You may choose those that are relevant to your project.

- Involve all partners and participants in ongoing considerations of RRI throughout the project life.
- Draft and regularly update your data management plan to ensure the sustainability of your research (consider the use of open access data storage platforms).
- Disseminate results/outcomes of your research on open access platforms (ex. arXiv, Github, etc.).
- Disseminate your research results/outcomes towards the general public (scientific outreach).
- Reflect on your research with regards to ethical issues, in particular with regards to privacy and data protection issues, IP protection, etc..
- Encourage the implication of early career researchers in your research projects.
- Provide equal opportunities for researchers of all genders (see annex 2).
- Involve relevant stakeholders in your project at the earliest possible stage and consider the involvement of RRI experts in your project implementation.

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Annex III. Women Leaders' Views on Gender Challenges in Quantum Research Culture

QUANTERA

"It is very important to recognize that something is so much embedded in stereotypes that you are not even aware of the impact your gender has on your working experience." Interview with woman leader in quantum, 2022

WOMEN LEADERS' VIEWS ON GENDER CHALLENGES IN QUANTUM RESEARCH CULTURE

Introduction to gender & physics

There is hardly any literature on the specific situation of women and gender issues in the QUANTUM field, so we can only take the literature on gender & physics as a proxy for the status of gender equality and its gendered practices and institutions in Quantum Technologies (QT). While most of the analysis have focused on the causes of the low numbers of teenage girls choosing physics in many countries, other studies have analysed in detail the academic career in physics from a gender perspective, which is rather the focus of this article. The physics field has been the subject of particular discussion among gender & science specialists due firstly to the marked under-representation of women in this research area from the undergraduate level to the highest academic positions. The literature has shown how physics departments are gendered at the level of interaction, images, symbols and mental constructs and this in itself constitutes a barrier to women's academic careers. The model that best fits these gendered institutions, that is the ideal worker in physics research is an independent, autonomous, flexible, committed and mobile researcher which is particularly problematic when it comes to ensuring work-life balance.[51]

Moreover, the physics field has also received particular attention due to the widely held idea within the community that *physics is different* and the consequent need to seek for explanations of a situation that is essentially different from the other fields. This was the case in some of the discussions taken in the framework of the GENERA project to develop gender equality plans in physics institutes.[52] However, the literature and evidences collected in the framework of gender & science European projects show that many of the barriers and obstacles women face in the physics field – work-life balance, masculine informal networks, unbalance decision-making, sexist and sexual harassment - are shared by women in other fields of research in different global regions because they are part of an academic system and career model, more and more globalized. Even if *physics is not so different*, there is a particular image of the field and of the people working in the field with a gender impact in terms of women's involvement in physics: the discipline has been presented as "the one" able to explain how the world works and this important task is reserved for the boldest and the most intellectually brilliant. Several authors, following Evelyn Fox Keller's footsteps, have stated that to be accepted as a member of this highly competitive community, one must be fully committed (read with no outside responsibilities and interests), charismatic, dominant and aggressive.[53] Thus, the organizational culture in physics-related institutions and the public image of the field projected through physics teaching and communication activities are two main areas that require further work to promote gender equality in physics research.

This is precisely why another best way of getting closer to the particular status of gender equality in the quantum field are the surveys on organizational culture from an EDI (Equity, Diversity and Inclusion) perspective that have been developed by the Quantum Flagship EDI Working Group.[54] The last data

[51] Kristina Rolin and Jenny Vainio (2011), "Gender in academia in Finland: Tensions between policies and gendering processes in physics departments", *Science & Technology Studies*, 24 (1): 26-46.
[52] See the GENERA Project funded by the EC under Horizon 2020 whose aim was to develop gender eqality plans in physics research performing organizations: https://genera-project.com/
[53] Meytal Eran-Jona and Yosef Nir (2021), 'Choosing physics within a gendered power structure: The academic career in physics as a "deal"', *Physical Review Physics Education Research*, 17, 020101: 3.
[54] https://qt.eu/working-groups/equity-diversity-and-inclusion

collected in 2019 showed a prevalence of discriminatory practices experienced by researchers in the field but also that most of the quantum community view gender inequality as an issue that needs to be tackled.[55] Testing the working environment and common ideas about gender equality over the years gives us valuable information to design effective actions for the quantum field.

QuantERA insights to the topic

QuantERA II promotes visibility of women's presence in QT through different initiatives, such as the inclusion of data on gender balance in every funded Project presentation during Programme conferences[56] and the promotion of balanced panels of speakers in quantum-related events. This is part of the objective of "Highlighting the presence of female researchers among the Coordinators of the QuantERA-funded Projects in QuantERA communication and PR materials" under Task 5.4 Towards a more gender balanced QUANTUM field. This article builds on another initiative to increase women's visibility and also to contribute to a more gender-sensitive organizational culture.

During 2022 a series of interviews with women coordinators of Projects funded under in the 2017, 2019 and 2021 QuantERA calls were conducted. The interview guidelines combined both questions related to the quantum research field, such as the reasons for choosing QT and Project's impacts on technology and society, and to the research career in quantum as women leaders. This article focuses exclusively on the topics related to gender issues, since its aim is to provide some insights and recommendations towards a more gender balanced field, by using women researchers' own words.

In this sense, a clear contrast can be observed between the feelings and emotions that women leaders expressed when talking about choosing the quantum field as their area of expertise and those that refer to the research career and organizational culture in R&I institutions. While excitement and inspiration described in all cases the feelings related to the content of the research in QT, conflicting emotions described as feeling guilty, harmed, annoyed, isolated, vulnerable and fragile are outstanding when describing what it means to navigate the quantum field.

In spite of these ambivalent feelings about the research field, several interviewees showed an optimistic attitude towards the future of women's representation in QT with expressions such as "the rest of the consortium did include women PhD students and postdocs", "we anticipate that with PhDs and postdocs the consortium will be more balanced", and "I think the pattern is changing". However, gender imbalance in academia is particularly pronounced in physics and women's representation has shown no significant increase despite dedicated efforts in the US, Europe and globally.[57] The data suggest that simply letting time pass will not bring a solution to a problem that should no longer be seen as a "women's problem". As expressed by one of our interviewees: "Currently men dominate in science, and there is no balance. This makes the overall system poor, and the view restricted" (IN5).

Therefore, it is important to recognise firstly that this is a problem that concerns all actors involved in R&I systems and secondly, to recognise that coordinated actions at all levels are needed, from the early years at school to the research centres, and research groups themselves. It has been quite common in the STEM fields to point to the early stages of the education system as having the solution to the underrepresentation of women in research, without looking at all those direct and indirect gender discriminations that take place

[55] https://qt.eu/news/2023/2023-06-19_EDI-survey-2023
[56] See QUANTERA Strategic Conference 2022 https://quantera.eu/strategic-conference-2022/
[57] Meytal Eran-Jona and Yosef Nir (2021), 'Choosing physics within a gendered power structure: The academic career in physics as a "deal"', *Physical Review Physics Education Research*, 17, 020101: 1.

in the selection processes, informal networks, practices of research centres and groups, among many others. As summarised by one of our interviewees:

> ***There are obviously many different levels of this painful lack of equity and inclusivity, starting from** [the lack of credit]**, then accounting the impact of unconscious bias in the hiring processes, the problems we have in the family-work balance during maternity leave, culminating in the cases of sexual harassment. We have to work on all of them in order to be effective**.* (IN3)

The Gender Equality Statement attached to the QuantERA II 2021 call — supported by all the funders involved in the consortium — precisely stated that "the promotion of STEM vocations free from gender stereotypes should start at the level of schools" while being aware of the impact that research funding organizations can have in the quantum field and encouraging physics institutes and departments as well as researchers in physics and in QT themselves to take concrete actions.

Facing common and specific barriers

Women leaders in QT have pointed out several barriers when asked about women's research careers in the field. Some of them are particular barriers for women in the STEM field, such as underrepresentation from the undergraduate level, while others are shared with the rest of the research fields because they have to do with a particular organizational culture of R&I institutions, such as work-life balance and sexist micro-behaviours. It is important to note that more and more young men are taking on domestic and care work, and also that some sexist micro-behaviours and homophobic aggressions can be suffered by men who don't conform to gender norms and LGBTIQ people as well. Indeed, both women and men researchers suffer from some of the most stressful aspects of the postdoctoral period in the global academic labour market that were mentioned in the interviews: precarious contracts and international mobility requirements. However, even though these labour conditions affect everyone, there is still an additional gender burden:

> ***An obstacle that I see in choosing a research profession is a long time before one gets a stable (permanent) position. This is a problem for everyone but especially for women wishing to have a family**.* (IN2)

Starting from the beginning, **women's underrepresentation** is an issue in itself since the lack of diversity in R&I institutions is not harmless. Women leaders recognize the fact of being frequently the only woman PI in their research collaborations and express the feelings of isolation this can produce, and even the feeling of "not being adequate" for the field:

> *[…]* ***feeling isolated sometimes is one of the issues. […] I think it is just all a little bit harder because of a lack of diversity.*** (IN1)
>
> *[…]* ***even the feeling of "not being adequate" (that is something very common in the academic world) is certainly more often and more firmly experienced by women***. (IN3)

Having to be used to this exceptionality of a woman leader in the physics field certainly leads to different strategies identified by the literature, such as distancing themselves from their own gender group and conforming with gender imbalance. Another adaptation strategy would consist of getting used to the unbalance and normalize it:

> ***I'm used to the situation when I am the only female researcher at the table. It happens quite often so at some point I stopped noticing it anymore**.* (IN5)

The level of awareness and integration of **work-life balance** in the organizational culture is crucial for women's research careers. There is wide consensus in the literature that the current model of research career is not compatible with the time that care work requires, especially when the ideal scientist continues to be the one who has no family responsibilities and can dedicate all their entire life and energy to research.

Every single work in the field of gender & science confirms that work-life balance, and particularly the culture of long working hours makes women drop out of the race to a greater extent than men.[58]

Several of the women leaders in quantum have referred to maternity and care work as an important gender issue in their professional careers. Sometimes women researchers have to face difficult decisions about their personal life and even their reproductive rights (the desired maternity postponed), which leads to feelings of vulnerability and guilt. The consequences of maternity and paternity cannot be considered equally for a research career since the time dedicated to domestic and care work is not equally shared in most countries and also because of the pregnancy and early childcare:

> ***When you are at the age when you want to have children, this matter starts to have a huge impact. Trying to balance the two aspects of your life, makes you feel vulnerable and fragile.*** (IN3)

> ***I got married and I had my first child when I was over 40 years old […] We support each other a lot, but the point is I definitely work too much. In the work-life "unbalance" it is generally the family that suffers more than work.*** (IN5)

> ***Unfortunately, I had to reject many invitations to prestigious conferences or programmes due to pregnancy or early childcare. Eventually, one loses visibility if one does not participate in relevant events. This is not good for one's academic career.*** (IN4)

Moreover, the different facilities that some countries provide have also an impact on whether or not to increase the imbalance:

> ***Some** [obstacles] **are at an even higher political level, in relation to the political situation in a single country. The paternity leave that exists in Spain and Sweden, for instance, is something that we can only dream about in Italy.*** (IN3)

Although national policies and institutional policies may be more or less supportive, the "impossible balance" is due to the competitive nature of the R&I field that makes constant high productivity a mandatory requirement:

> ***Regarding gender issues, work-life balance is a huge problem, but not because of QuantERA. It's a huge problem in our job, I think […]*** (IN5)

> ***I believe that it is difficult to combine family and professional life which is why there are less female scientists.*** (IN2)

While work-life balance issues are indeed very relevant and play a major role in gender equality policies, the working environments in R&I institutions have recently been singled out as an even more relevant factor when it comes to women's retention in research careers.[59] The marked underrepresentation shapes precisely an **organizational culture** based on a traditional "masculine" model where sexist micro-behaviours are tolerated and minimised. These harmful practices may include sexist comments targeting the role and performance of women researchers as mothers, uncomfortable situations experienced by women who have a position of power, and also the perceived lack of credit as women scientists:

> ***I remember perfectly when I was pregnant with my second child and at the coffee machine a full-time professor asked me: "but now, you have to really choose if you want to be a good scientist or a good mother". This is one of the things you are regularly confronted with.*** (IN3)

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[58] Cukut Krilić, Sanja, Majda Černič Istenič y Duška Knežević Hočevar (2018), "Work–life balance among early career researchers in six European countries", en Murgia, Annalisa y Barbara Poggio (eds.), *Gender and Precarious Research Careers. A Comparative Analysis*. London: Routledge, 145-177.

[59] Saima Sidik (2023), "Toxic workplaces are the main reason women leave academic Jobs", *Nature articles* https://www.nature.com/articles/d41586-023-03251-8

I also feel that there are people who are really upset by the fact that a woman can achieve success. (IN5)

In many other circumstances I simply had the feeling that I had to be twice as good to prove that I am worthy. And this is really annoying… (IN3)

A much more serious issue, that is also embedded in the organizational culture, refers to sexual harassment as one of the forms of gender-based violence and has traditionally been silenced in academia. The persistence of cases of sexual harassment has come up in two of the interviews:

Sexual harassment exists, and it happens from time to time. It is very disappointing, but unfortunately it happens everywhere. (IN5)

Sexual harassment has acquired much more relevance in the last years in the framework of the ERA. The development of zero-tolerance policies to address sexist and sexual harassment is one of the objectives of the ERA Policy Agenda Action no.5 “Gender equality and inclusiveness” and several coordination and support actions have been funded by the EC to tackle this problem. In this context, not only Research Performing Organizations (RPOs) are called to take actions to prevent and adequately deal with cases of sexual and sexist harassment but also Research Funding Organizations are expected to implement policies and to have a proactive role to eradicate all forms of gender-based violence from academia.

Finally, although this article focusses on highlighting those obstacles and barriers women leaders raised in their interviews, it is important to notice that not all aspects of the academic environment were reported as negative. To give an example, while there are specific barriers for women to access leadership positions and this responsibility could be experienced as stressful, for several of the women leaders interviewed this was a challenge they managed to achieve and that provided them self-confidence:

At the beginning I felt a lot of pressure because I was coordinating very highly renowned scientists. Did I have to know everything? I did not! So, I decided to be honest about it and if something was not really within my expertise, I asked someone else […] (IN3)

Moreover, some of the issues that constitutes a barrier in a given context, may be experienced as supportive by others. Those ambivalent aspects include the working environment that women researchers encounter:

[…] I must say that sometimes there are also people who really care about your growth and they encourage you despite the difficulties because they know that there are not enough women in the field. (IN5)

Gender equality policies as window-dressing?

Gender equality policies in the R&I field comprises all coordinated actions designed to address the obstacles towards a balanced representation at all levels, the barriers for an equal research career, biases in the content of research and teaching, and the steps towards an inclusive and safe working environment. In the quantum field, as in the broader field of physics, there are different, competing discourses around gender equality and inclusiveness. In line with the results from the 2019 EDI survey and also with previous experience interviewing physicists, the QuantERA interviews showed a minority discourse that is suspicious of the effects of gender equality policies and a gender-sensitive mainstream discourse that supports these measures. Both discourses coexist in the quantum field.

On the one hand, those policies targeting gender balance, and particularly positive action measures, are perceived as potentially harmful to the women they claim to benefit:

I find the attempts to “brute-force gender balance” our community quite delicate. I am afraid that a few years from now, most of female achievements might be questioned and appear as gifted within a “gender balance action”. For example, even though this is probably not the

> ***case, I have already started to doubt my own successes. I really believe that quality should always be the first criterium in hiring and evaluation processes […].*** (IN2)
>
> ***I remember a comment from the QuantERA webinar where someone asked if science in the proposal still matters at all or is it only about gender balance. We should not get there…*** (IN2)

This kind of discourse emphasizes the "excellence" criterion above all and considers gender equality measures as undermining "excellence". First, the specialized literature has criticized the idea of "excellence" in the R&I field for being gendered[60] and this is precisely the reason why gender experts in the field recommend reviewing this concept and its gender impact. Second, for decades both the academic literature and official reports have provided extensive evidence of the direct and indirect discrimination women have experienced in R&I, some of which have appeared in the discourse of quantum women leaders. Thus, the discourse of "quality first" leads to stop focusing on all the diverse forms of discrimination and instead focus on presenting gender equality as opposed to rigour, by hiding the fact that inequalities give as a result different merits. Given the preexisting bias and unfair situation, gender equality policies in no way damage the "objectivity" of the system, but rather help the system to promote fairness and quality.

However, it is important to give credit to women's concerns about the judgements that can be made of their successes as scientists because they show that harmful discourses are part of the resistances and obstacles they may face. Moreover, regarding the discourse that associates the introduction of gender equality measures as ignoring any other criteria in the evaluation of proposals, it actually distorts the reality of the calls for proposals and evaluation process and can be considered a form of resistance to these policies. Revealing precisely where these **resistant discourses** are and what forms they take is essential to understand what lies behind them and to be able to address them.

On the other hand, several of the interviews showed a supportive discourse for gender equality policies, especially for the younger generation of scientists. However, precisely because there is a previous awareness of these issues, there is a constant demand for effectiveness in the discourse of these interviewees, particularly when it comes to measures to achieve gender balance:

> ***Nowadays we can hear and read about gender balance all the time, as the topic becomes more relevant. Whether is this proportional to the success of real inclusiveness, I do not know.*** (IN3)
>
> ***[…] just to write in a call announcement that it is good to have women PIs or to have women as part of the team – does it have any real meaning in the end?*** (IN3)
>
> ***Being part of evaluation committees, my impression is that while gender balance is discussed, it is not really taken into account in the evaluation and does not affect the outcome***. (IN4)
>
> ***I am not an enthusiast of "giving priority to women", but I think that within a transition period it's really necessary because it's the only way to arrive at a balance.*** (IN5)
>
> ***[…] we need to have clearer, more explicit actions. Not words, but actions to achieve a balance.*** (IN5)

This is precisely why it is so important that gender equality policies are well designed and have a real impact that institutions and funders can show. The most critical voices among quantum women leaders even questioned whether some of these initiatives are in the end window-dressing since any reputable R&I institution nowadays cannot ignore gender equality and inclusiveness issues and the deep cultural change they entail:

> ***I see other mechanisms: you are a good scientist, and you are a woman, so I would like to use your face to create an inclusive image of the field.*** (IN3)

[60] Van den Brink, M., Y. Benschop (2011), "Gender Practices in the Construction of Academic Excellence: Sheep with Five Legs", *Organisation*, 19(4): 507–524.

I am invited to many conferences that is even too much because I cannot travel that often. But when it is time to make the decisions, it is still an "old-men club". Then there is no space for me there. (IN3)

Conclusions and recommendations

The interviews conducted to women leaders in the quantum field speak volumes on different measures that could be helpful to address gender imbalance in QT, which is one of the aims of the work of QuantERA II regarding responsible research and innovation. While continuous monitoring of the figures is a relevant task, women's and men's voices in the field let us capture the ways in which people experience and interpret their realities and thus, we are able to have a deep understanding of the community we want to engage with. This is why exercises such as the survey launched by the EDI Working Group and the interviews with women leaders conducted by QuantERA II are so valuable insights into the topic, especially for a research area so distant from qualitative techniques.

With the help of women leaders' own words, we have been able to explain some of the most relevant barriers and obstacles for women's careers in R&I already studied by the field of gender & science. Women leaders in quantum have suggested taking action in several of the areas discussed above. There are several recommendations to address work-life balance at institutional level, but also to facilitate care work during conferences in the field, recommendations to promote gender balance through role models and also small changes suggested in working practices, as summarised in the matrix below:

	Institutional level	Research community's activities	Individual practices
Gender balance	*On funding agencies level, it would perhaps help if there were some formal incentives to create more gender balanced teams and consortia.* (IN4)	*[…] to make sure that there is a balanced audience or balanced panel of speakers at project meetings and conferences.* (IN3)	*I should mention one famous male professor whom I know to refuse invitations where there isn't a minimum percentage of women as speakers.* (IN4)
Role models	*What the institutions can do is to increase the visibility of women researchers.* (IN1)	*[…] having visible role models is encouraging for students and young researchers. Knowing strong figures with recognizable style was always empowering also for me. It made me search my own style.* (IN2)	
Supportive environment	*It is important that they [institutions] provide ways for women researchers to be in touch with their peers so that they do not feel isolated.* (IN1)		*I would love to have had more support from my colleagues back then [from maternity leave]* (IN3)
Work-life balance	*One thing we said we would try to push forward in our institutions is to create a more family-friendly environment, eg, family rooms to help researchers combine their professional and parenting tasks.* (IN2)	*There are a lot of times you get invited to panel discussions about work-life balance or gender equality and it is only women who participate. That is perpetuating this*	*As for the team, we always try to have meetings in suitable hours.* (IN5)

	Perhaps at least parental leaves should be seriously balanced for in various application processes [...] (IN2)	***idea that this is a problem for women.*** (IN1) ***We could consider allocating a small budget for the childcare or caring in general during participation in workshops or conferences.*** (IN3)	
Decision-making, leadership	***[...] to require the participation in unconscious bias training for all the PIs. If you really want to be the leader in a European project, you have to know how to deal with these things.*** (IN3)		***I think one important point concerning the role of a project leader is to make sure that people are given the same credit. It is important to avoid a situation when one person performs the work but then only the professor attends the meetings and gives the speeches, for instance.*** (IN3)

Several of these actions can be good ideas for GEPs in quantum-related institutions of the ERA that need to follow the eligibility requirement as beneficiaries of Horizon Europe. The EC framework for GEPs includes five content-related areas considered as essential factors for gender equality in the R&I field: 1) Work-life balance and organisational culture; 2) Gender balance in leadership and decision-making; 3) Gender equality in recruitment and career progression; 4) Integrating the gender dimension into research and teaching content; 5) Measures against gender-based violence, including sexual harassment. The interviews with quantum women leaders have provided relevant insights to address these fields of action in QT.

Finally, one of the actions that appeared in the interviewees' thoughts was clearly an indication for QuantERA II of the way forward to achieve gender equality in the field: the relevance to interrogating – in the best sense of the word – men as well, and involving them in gender issues:

> ***I would like to see more encouragement for men to also be involved and talking about these issues. […] I think if these things are still not viewed as being equally important for men and women, then it is not really solving the full problem.*** (IN1)
>
> ***I guess it would make sense to involve the male coordinators in such actions as well. We shouldn't make female scientists the special "species" that must be protected or pushed forward.*** (IN2)
>
> ***It would be nice if these interviews were also extended to male coordinators. This would be highly relevant as it is not just a problem for women!*** (IN3)

Indeed, QuantERA II considers that building a gender-sensitive culture in quantum-related institutions and research groups is a shared responsibility that will benefit all genders in the field, and thus everyone is invited to contribute to the goal of building a more gender-balanced quantum field.

"I really hope that my daughter will live in a different world, although compared to the previous generation, I cannot complain. There are situations in which I don't realise I am a

woman. When I do, it is tough." Interview with woman leader in quantum, 2022

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