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On 10 October 2024, RAND Europe and the Novo Nordisk Foundation co-hosted a roundtable discussion in Copenhagen to explore key aspects of the quantum technology ecosystem, given the rapid global advancements in cutting-edge research and innovation in the field. This was the second in a series of events aimed at bringing together thought leaders, researchers, industry experts and policymakers who are committed to helping responsibly shape the future of quantum technologies. The inaugural roundtable had taken place in London in November 2023, where discussions centred on ideas for promoting innovation while ensuring a safe and equitable future enabled by quantum technologies. The focus of this roundtable was on two critical issues that are likely to influence the direction of this rapidly progressing field: the development of skills and talent, and the strengthening of supply chains.

This short report provides a summary and overview of the discussions and insights from the skills and talent component of the roundtable. We find that the global quantum technology ecosystem is becoming increasingly diverse, integrating various expertise and disciplines, yet faces challenges to the availability and distribution of necessary skills. To build a sustainable talent pipeline, a coordinated, long-term approach involving enhanced educational programmes and multistakeholder collaboration was highlighted as essential to strategically improving quantum literacy and workforce readiness.

Drawing on the discussions, we propose a selection of policy considerations and associated enabling actions that stakeholders within the broader quantum technology ecosystem could take to address issues related to skills, talent and workforce development.



The policy considerations are organised into three clusters, each reflecting common themes: connecting, collaborating and community building; expanding and diversifying skills and perspectives; and approaching skills systems holistically with forward planning. Taken together, these policy considerations can be regarded as a set of crosscutting principles intended to guide stakeholders in addressing challenges proactively and holistically, with the aim of developing a more resilient, equitable and future-ready quantum technology skills pipeline and workforce.

The analysis following the roundtable discussion reported here was internally funded by RAND Europe and has been peer-reviewed in accordance with RAND's quality assurance standards. This work is intended to inform the public good and should not be taken as a commercial endorsement of any product or service.

We extend our gratitude to the roundtable attendees for their participation and insightful contributions. Additionally, we wish to thank the quality assurance reviewers at RAND Europe, Hans Pung and Susan Guthrie, for their critical review of the report. Finally, we express our thanks to Jessica Plumridge and Georgina Melia for designing and laying out the report and Ruby Russell for her copyediting work.

RAND Europe is a not-for-profit research organisation that aims to improve policy and decision making in the public interest, through research and analysis. Our clients include European governments, institutions, non-governmental organisations and firms with a need for rigorous, independent, multidisciplinary analysis. This roundtable was delivered as part of RAND Europe's Frontiers of Technology Hub, where we pursue a proactive research agenda to anticipate and prepare stakeholders for emerging technologies and their impacts.

Novo Nordisk Foundation is a private, independent, philanthropic enterprise foundation. They provide grants and investment in the public sector for scientific, humanitarian, and social purposes. Their vision is to improve people's health and the sustainability of society and the planet. They have since 2019 been a key player in supporting and growing the Danish quantum ecosystem with grants, investments, partnerships and activities.

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In recent years, the capabilities of quantum technologies have advanced significantly, underscoring their potential applications across diverse fields, including the life sciences, finance, aerospace, defence, energy and telecommunications. In recognition of the centennial year of the development of quantum mechanics, the United Nations (UN) has designated 2025 as the International Year of Quantum Science and Technology, seeking to raise global awareness and understanding of quantum applications across various sectors. Against this backdrop, on 10 October 2024, RAND Europe and the Novo Nordisk Foundation co-hosted a roundtable discussion in Copenhagen to explore key aspects of the quantum technology ecosystem, given the rapid global advancements in cutting-edge research and innovation in the field. This was

the second in a series of events aimed at bringing together thought leaders, researchers, industry experts and policymakers who are committed to helping responsibly shape the future of quantum technologies. The inaugural roundtable had taken place in London in November 2023, where discussions centred on ideas for promoting innovation while ensuring a safe and equitable future enabled by quantum technologies. The focus of this roundtable was on two critical issues that are likely to influence the direction of this rapidly progressing field: the development of skills and talent, and the strengthening of supply chains.

This report captures the perspectives and insights of participants at the roundtable, serving as a concise guide to inform and contribute to the broader stakeholder discourse on quantum technology skills



and talent, as policy on these key issues develops over the coming months.1 It is widely recognised that skills, talent and competencies are crucial to advancing economies in general; however, they are particularly vital to constructing resilient workforces and maintaining progress in advanced technology domains like quantum technology. Alongside other structural factors such as funding, infrastructure, collaboration and oversight, skills development can be considered one of the essential enablers of the broader quantum technology ecosystem. We discussed that the quantum technology ecosystem is facing a skills gap, which stakeholders are actively striving to bridge. Ultimately, strategically investing in skills and talent development is essential to cultivating robust ecosystems capable of supporting the ongoing evolution and expected impact of quantum technologies.

Drawing on the roundtable discussions, we offer a selection of high-level policy considerations and associated **enabling actions** that stakeholders within the broader quantum technology ecosystem could take to address issues related to skills, talent and workforce development. Figure 1 provides a visual representation of the policy considerations. Taken together, these eight policy considerations can be regarded as a set of cross-cutting principles intended to guide stakeholders in addressing challenges proactively and holistically, with the aim of developing a more resilient, equitable and future-ready quantum technology skills pipeline and workforce. We organise the eight policy considerations into three colour-coded clusters, each reflecting common themes across the respective policy considerations.

We believe that these principles could underpin a future 'Quantum Technology Skills Charter', articulating a collective statement of intent, ambition and commitment among stakeholders including public, private and third sector (including civil society) entities. This charter could facilitate focused, coordinated efforts and actions to proactively address the key challenges related to quantum technology skills and the broader workforce.

The main **cross-cutting themes** that emerged during the discussion are as follows:



The global quantum technology ecosystem is evolving to become increasingly heterogeneous encompassing a range of expertise and disciplines.



There are key challenges concerning the availability, types and distribution of skills pertinent to advancing the quantum technology ecosystem.



Universities worldwide are expanding quantum-related degree programmes and research opportunities, while industry players are also increasingly developing educational content and tools, collectively enhancing quantum literacy and workforce readiness.



The development of a robust, sustainable quantum technology talent pipeline will require adopting a patient, long-term approach that targets different learning levels across the education and skills development journey.



Addressing the quantum technology workforce development challenge necessitates coordination community building and common standards.

A forthcoming companion report will provide a summary of the discussions related to the supply chains component of the roundtable.



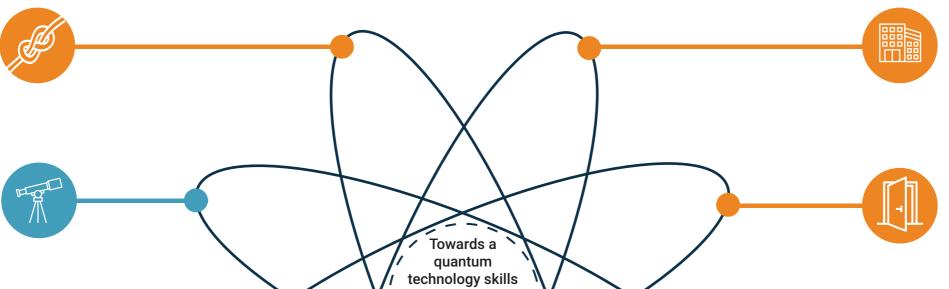
Figure 1: Eight policy considerations for stakeholders within the quantum technology ecosystem to address issues related to skills, talent and workforce development (note: policy considerations are organised into three colour-coded clusters, each reflecting common themes: connecting, collaborating and community building; expanding and diversifying skills and perspectives; and approaching skills systems holistically with forward planning)

# 8-point plan to help build a resilient, equitable and future-ready quantum skills pipeline and workforce

EDUCATE | ENGAGE | EMPOWER

#### Policy consideration 1. Join forces with trusted partners

Establishing and nurturing cross-cutting partnerships between various stakeholders - notably academia and industry - can help bridge the quantum technology skills gap.



## Policy consideration 2. Leverage the local

While global and national efforts to develop quantum technology skills and talent are key, it is equally important to focus on tailored initiatives and activities aimed at enhancing regional and local quantum technology ecosystems.

## Policy consideration 3. Forge inclusive public outreach and learning practices

Implementing comprehensive and inclusive public education initiatives focused on quantum literacy to enhance awareness, accessibility and understanding of quantum technologies could help cultivate interest and attract potential talent from a diverse range of sources.

### **Policy consideration 7. Apply** broad skills frameworks strategies

**Policy consideration 8. Actively** 

prepare for future developments

foresight strategies is vital to obtain

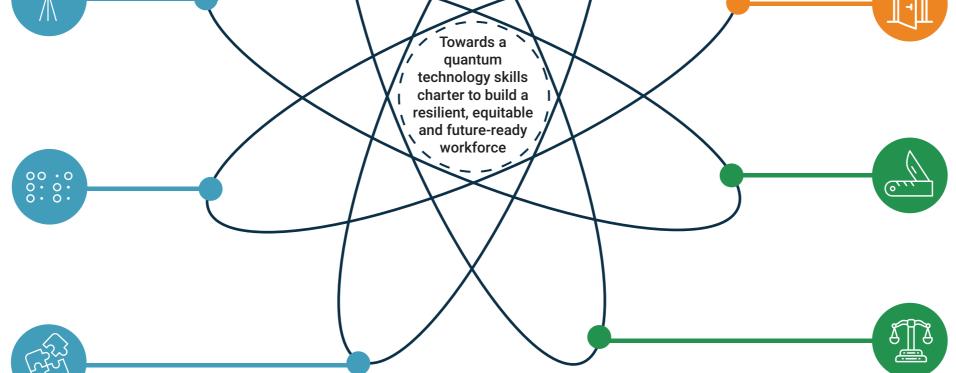
quantum technology skills.

Embracing proactive skills monitoring and

evidence-based insights into the dynamic.

evolving supply and demand landscape for

Adopting a systematic approach based on comprehensive competency and skills frameworks could enhance assessment and anticipation of skills needs within the quantum technology ecosystem.



## Policy consideration 4. Broaden the range of skillsets

Beyond technical skills directly associated with quantum technology, non-technical competencies and adjacent domain expertise are crucial to facilitate effective development and commercialisation of the technology and its applications.

### Policy consideration 6. Develop alternative and flexible learning routes

Creating more adaptable and modular learning pathways is important to allow professionals from various backgrounds to continuously gain quantum skills throughout different phases of their careers.





### Policy consideration 5. Embed public interest and social good thinking

To responsibly address potential risks and equitably share the benefits of adopting quantum technologies, and to develop effective governance frameworks, it is important to integrate social sciences, arts and humanities, alongside ethical and legal perspectives and its applications.

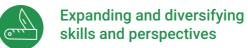






Connecting, collaborating and community building



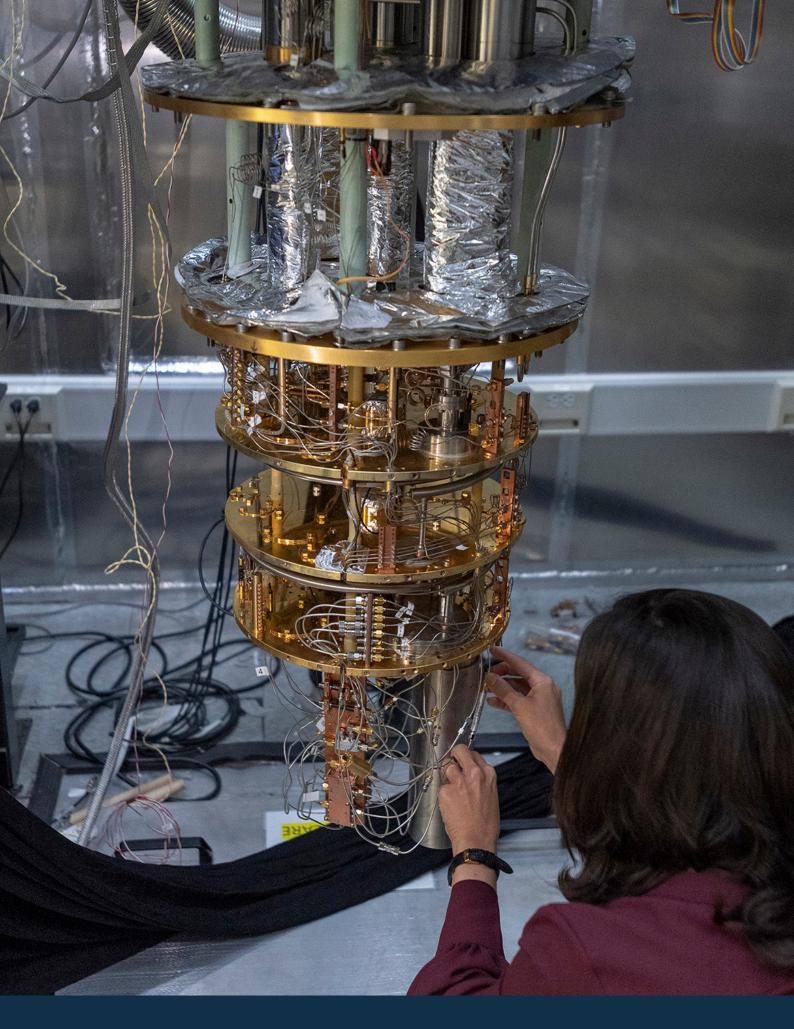








Approaching skills systems holistically with forward planning



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