Quantum Technology Flagship community consultation report

Draft 19th September 2016

On the 24th June and on the 15th September of 2016, a working group of scientists appointed by the QUTE-Europe Scientific Advisory Board met with representatives from industries active in the field of Quantum Technologies. The purpose of the two meetings was to agree on recommendations for the setup and running of the quantum technology flagship. A list of attendees to those meetings can be found in the appendix below. The intention of this paper is to summarise the consensus reached following those meetings and the subsequent consultations with the QT community*, and to inform the Quantum Technology flagship high-level steering committee. The vision was agreed as:

Goal

- to place Europe at the forefront of the second quantum revolution now unfolding worldwide, bringing transformative advances to science, industry and society, in synergy with national QT programmes

Values (not in prioritized order)

- goal oriented academia-industry partnerships combined basic, R&D and industrial research, while paying attention to open scientific and technology issues
- transparency in the development process for each aspect of the program
- openness to involving emerging actors, attracting the best talent also from other fields
- flexibility in the governance, allowing the program to focus and adapt to the evolution of the field
- sustainability over a time scale going beyond the Flagship itself
- accountability to the community, member states and the wider society
- fair evaluation of proposals with highest priority to excellence and impact in fundamental, applied or industrial research
- pan-European dimension (virtual network infrastructures rather than geographic centres) with equal opportunities for all qualified teams (regardless of their size) to contribute
- a research agenda containing strong elements of application and engineering focus, with demanding but realistic and achievable goals, in addition to basic research into enabling science, exploration of new concepts and systems, quantum algorithms and protocols
- facilitating the creation of a new generation of quantum scientists, engineers, and entrepreneurs

Governance

- strong strategy board based on wide and inclusive geographical representation and balance among the areas listed below, with mechanisms to update its membership (limited-time mandate) and clear rules for conflicts of interest

* http://qurope.eu/db/groups

- formed by “wise people” (retired from the field) avoiding conflict of interest while retaining excellent knowledge of the area
- gathering broad high-level input from community with the support of Virtual Institutes and Facilities representing thematic clusters to drive the process, to formulate flagship strategy and targets and to assess and benchmark progress
- executive board implementing decisions, supported by management level administering work programme and calls and ensuring efficient information transfer between various partners and stakeholders
- independent evaluation by peer review, based on excellence in science and/or innovation, with best practices (e.g. ERC-inspired) to deal with conflicts of interest
- coordination with member states and national funding organizations, both within member states and internationally, for synergy and alignment with national initiatives in the field of QT
- balanced representation from academia (including basic and applied science labs) and industry (including SMEs) at board level, building on existing cooperation to develop a strong integration between science and industry at all levels

Structure and operation (not in prioritized order)

- no core consortium, rather high-level strategy board; simplest management structure, possibly through an NGO (see, e.g., EURAMET)
- evolution from peer-reviewed open calls (possibly structured in two stages) in ramp-up phase to a mix of open calls and fewer focused projects in thematic "pillars" at steady-state phase (such evolution can be pillar-dependent, as each pillar has its own set of timescales)
- ongoing academia-industry strategic planning, to be started before the ramp-up phase, leading to a research agenda to identify the scope of the calls (i.e. define quantum technologies within each pillar) and to guide the direction of challenge led projects
- QT training programs based on PhD and postdocs’ excellence (no mobility requirements) including secondment to industry and/or research groups
- support for early-stage researchers in the ramp-up phase, to allow their development and integration into the community, and later into the "pillars" should they be successful
- strong elements of community building to inform and bring in the right players, for maturing the technology, extending the supply chain and market development
- development of a quantum-aware workforce through interfacing with training in science, engineering, and business; improving gender balance
- coordination services (financial management, work packages self-assessment, reporting, technology transfer) provided to R&I projects to relieve researchers from administrative duties
- EU-wide support provided for IPR protection
- effective outreach activities to ensure broad support from society for research in Quantum Technologies

- understanding that funding to industry, complementing industry's own investment, is essential to securing interest and commitment from industry in this area
- open consultation with members of the community before key decisions are taken

The groups agreed that four key 'pillars' of activity should be used to illustrate end user applications. These were agreed to be:

- Quantum Sensors and Metrology,
- Quantum Communication Devices and Systems,
- Quantum Simulators,
- Quantum Computers: Hardware and Software.

In addition, each end user applications should have a number of embedded activities, which may be cross cutting across the pillars:

- Quantum engineering and control
- Enabling science
- Theory, algorithms and protocols (including computational analysis and numerical experiments)

This simplified picture of the structure of the flagship should be taken as illustrative – other fields may exist within one or more of these headings.

The operational structure was agreed as:

Down selection and focus

- start with a larger number of projects (STREP-like, no individual grants; eligibility criteria set by the research agenda; geographical flexibility) in the ramp up phase, while requiring proof-of-principle and/or demonstrators among the projects' goals
- allow to a certain extent smaller consortia and/or bigger budgets for specific innovation projects
- require consortia to define both project objectives and long-term goals within the scope of the calls, and update on this basis the research agenda for the steady-state phase
- reduce the number of projects in the steady-state phase via strategic orientation of calls and instruments to evolve into possibly larger, more focussed consortia around the most promising and successful routes according to pillar development, from demonstrators to products
- use specific calls and instruments to maintain openness to the exploration of challenging new ideas, systems and concepts and flexibility to incorporate them and to test the applicability of known principles in new domains

Include application-oriented R&D with expectation of economic impact

- strong focus on operational prototypes and challenge led projects
- application focus reflected in strategy, calls, proposal evaluation criteria, evaluation
- technology development infrastructure

Balanced industry representation in the governance structures and assessment processes of the flagship

- important for promoting commercially relevant R&D
- obtain traction in industry with appropriate focus

Funded industry participation within all the mechanisms of the flagship (not in prioritized order)

- innovation exploration and start-up funding schemes
- flexibility in funding and instruments
- encouraging pre-commercial procurement, lowering the risk of early adopters by helping them access quantum technologies
- target at least 50% of the funding to be provided to support industry-led projects that will support joint research and development type activities
- these industry-led projects are collaborative projects, which include academics in their funding, but with an industry project lead, to organise the structure and delivery of e.g. prototype product demonstrators, feasibility demonstrators and more

Appendix – List of attendees

Academic Stakeholders

M. Aspelmeyer - Wien University
K. Banaszek - University of Warsaw
K. Bertels - Qtech Delft
D. Binosi - Fondazione B. Kessler
R. Blatt - Innsbruck University
H. Buhrman - Qsoft Amsterdam
V. Buzek - SAS Bratislava
T. Calarco - IQST Ulm
I. Cirac - MPQ Munich
D. Esteve - CEA Saclay
E. Giacobino - CNRS, Paris
N. Gisin - University of Geneva
S. Glaser - TU Munich
P. Grangier - IOTA Palaiseau
F. Jelezko - IQST Ulm
P. Knight - IC London
M. Lewenstein - ICFO Barcelona
J. Morton - UC London
E. Polzik - Niels Bohr Institute
R. Thew - University of Geneva
A. Wallraff - ETH Zurich
F. Wilhelm - Saarland University
A. Xuereb - University of Malta

Industry Stakeholders

P. Bianco – Airbus Defence and Space
T. Cross – e2v
T. Debuisschert – Thales
B. Desruelle- MuQuans
Y. Felk ID Quantique
S Isaksen - Qubiz
W. Kaenders – Toptica
P. Muller - IBM Research Zurich
R. Murray – Innovate UK
C. Reitberger -Wellington Partners
W. Riess - IBM Research Zurich
A. Shields- Toshiba Research Europe Ltd
T. Strohm- Bosch
V. Zwiller - Single Quantum