Quantum Industry and Policy Development of South Korea

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Brief Introduction to ETRI (est. 1976)

Purpose

Government Supporting **R&D Institute**

developing **Core·Future Technologies** in the fields

of Information, Communication, Electronics,

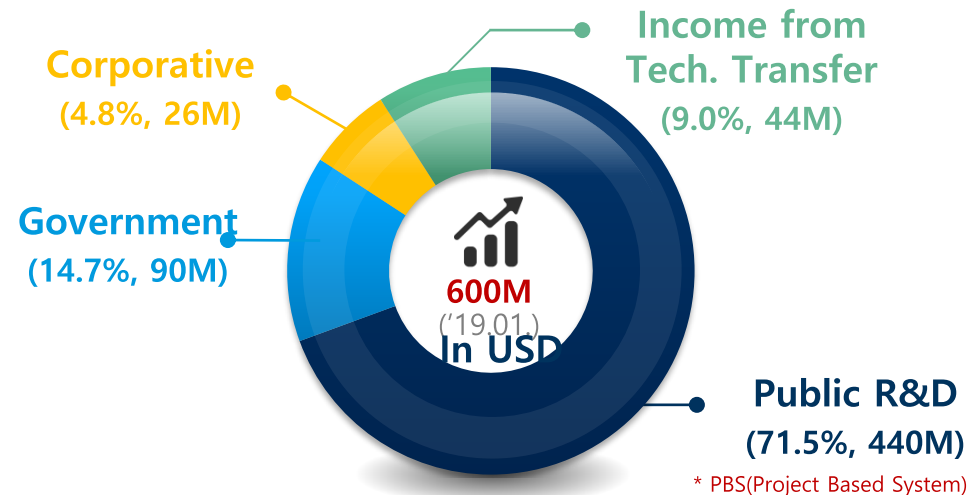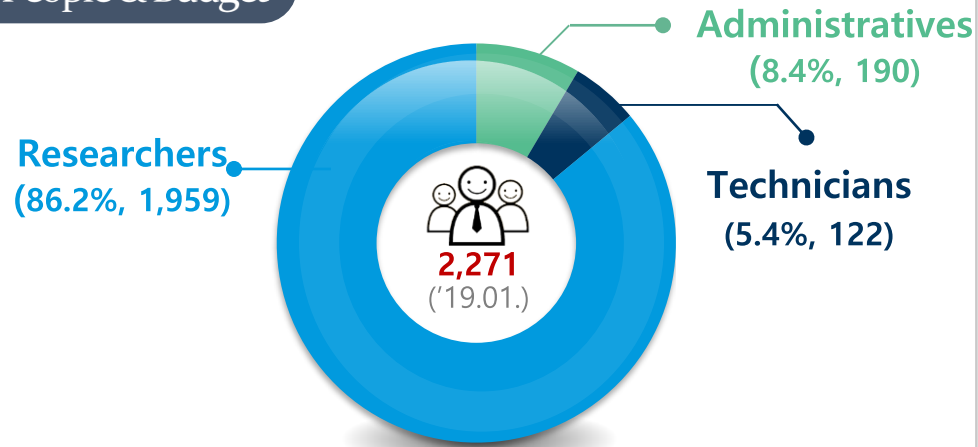Broadcast and ICT Technology Convergence.

Creation of national Growth Engine.

Mission

R&D (SW·Contents, Broadcast·Communications, Media, etc)

Support SMC (Corporate Support, Technology Transfer)

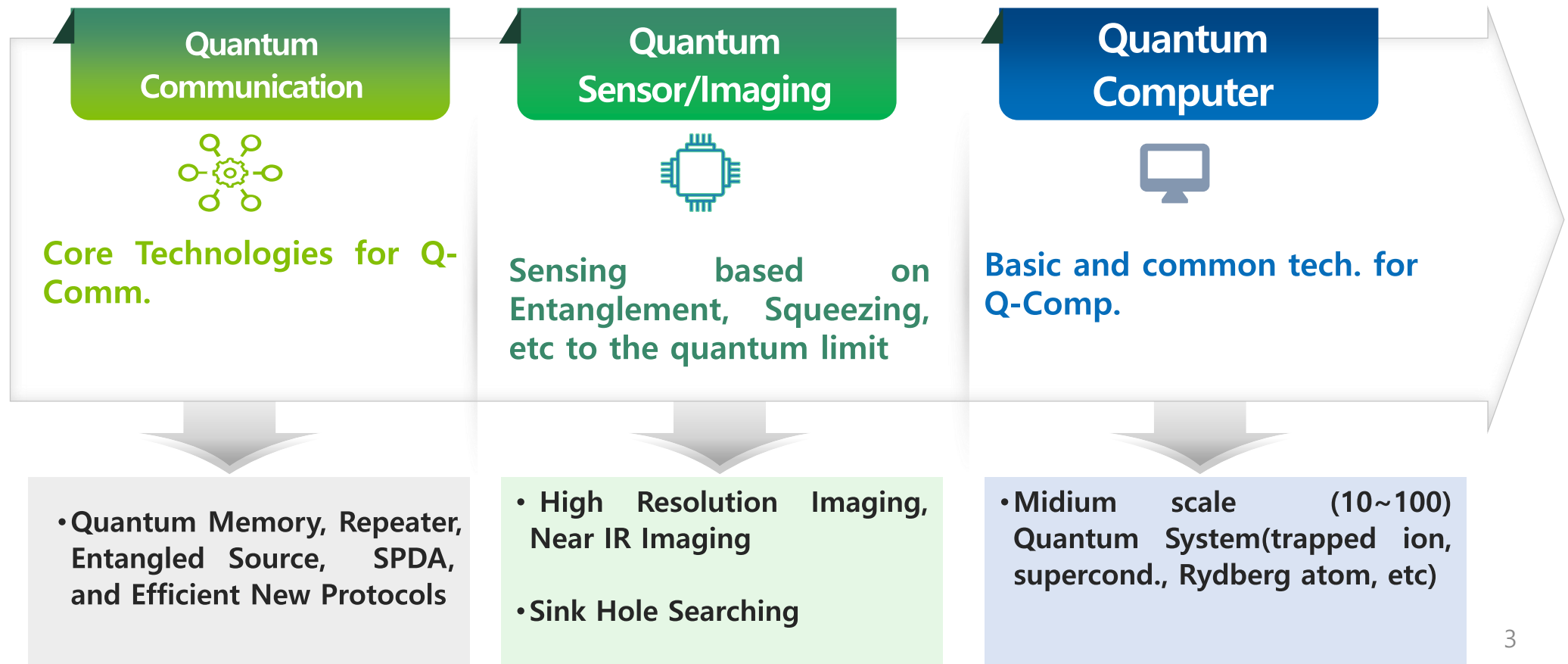**Services** (Training Experts, Support Policy Planning, etc)

People & Budget

Administratives (8.4%, 190)

Researchers (86.2%, 1,959)

Technicians (5.4%, 122)

2,271 ('19.01.)

Income from Tech. Transfer (9.0%, 44M)

Corporative (4.8%, 26M)

Government (14.7%, 90M)

600M ('19.01.)
In USD

Public R&D (71.5%, 440M)

* PBS(Project Based System)

Major Achievements

1978 TDX

1986 DRAM

1989 CDMA

1999 W-CDMA

2002 T-DMB

2006 OLED

2015 4K UHD

2016 AI for Korean natural language

Mid-term Quantum ICT Roadmap in Korea

- Quantum ICT is a Korean term for Quantum Technology/ Quantum (Information) Science to reflect the application to ICT.

- Scope (2018.Dec.)

Quantum Communication	Quantum Sensor/Imaging	Quantum Computer
Core Technologies for Q-Comm.	Sensing based on Entanglement, Squeezing, etc to the quantum limit	Basic and common tech. for Q-Comp.
• Quantum Memory, Repeater, Entangled Source, SPDA, and Efficient New Protocols	• High Resolution Imaging, Near IR Imaging • Sink Hole Searching	• Midium scale (10~100) Quantum System(trapped ion, supercond., Rydberg atom, etc)

R&D Direction dreaming in Korea

As is

- **Exit plan after market saturation of semiconductor tech. which led high growth of ICT tech. in Korea**
- **Increasing cyber attacks against corporations and government agencies**
- **External cyber attacks of electronic control devices in the automobiles**
- **Need of accuracy Improvement of measuring devices**
- **New solution need to overcome Moore's Law**

To Be

- **Catalystic technology to re-activate ICT technology in recession crisis**
  - Optical Comm. + Quantum → QKD
  - Semiconductor + Quantum → Q-Sensor/Imaging and Q-Computer
  - AI + Quantum → Q-Computer
- **Realization of unconditional secure communication environment through Q-authentification, q-signature, and QKD**
- **Creation of new industry sector that was considered impossible in digital computer era**
  - Designing of chemical molecular structure, new medicine and new materials
  - Solving problems of social issues requiring large amount of calculation: big data analysis for minimizing traffic jam

Main Strategies - 1

R&D

Quantum Communication

- ◆ As QKD is expected to be a candidate of commercialization in the near future, early development through cooperation with industry will be drived.

- ◆ In case of entanglement state based communi-cation, Goal-driven R&D will be performed so that high speed and long distance could be possible.

Quantum Computer

- ◆ Although huge impact is expected, because of lack of basics, it will be pursue as a fast follower.

Quantum Sensor/Imaging

- ◆ As quantum metrology has no distinct market trace, core and common basic technology will be launched

- ◆ As many other sensor systems(atom, NV center, SQUID etc) and different goal exist, overcoming the classical limit will be 1st goal.

- ◆ As a fast follower, high accurate single photon generator and detector will also be the 1st goal.

5

Main Strategies - 2

Standardization

- As ETSI, IEEE, ITU, ISO has discussed Q-ICT standardization, project for standardization will be launched to follow the international activities and collect the domestic opinions.

  * QKD protocol, error correction, privacy amplification, End-to-End network architecture for QKD network, QKD infrastructure etc

Workforce Training

- As a challenging technology deeply based on basic research, long term and stable funding to train workforce will be needed.
- As quantum technologies need many equipment and facilities, institutes having equipment will be starting point to establish programs for industrial/academic/research lab collaboration

Research System/Regulation Improvement

- In the field of Q-ICT, there are still unknown areas so the basic research for long-term duration is need.

  - Uncertainty for future technology possibilities and markets is uncleared, wide area will be supported rather than focusing area, and ensure continuity of research by evaluating research fidelity rather than achievements.

Quantum Computer R&D Details

Basic Core Technology and R&D ecosystems for Quantum Computer R&D

Core Tech. R&D

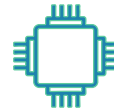**5-qubit Quantum Computing System (3 competing projects to 1)**

Quantum Simulator (2 competing projects to 1)

Quantum Algorithm and System (8 projects)

Practical Quantum Computing

R&D Ecosystem

Quantum Computing Tech. Forum

Publishing a white book

Seminar/Workshop

Global Collaboration

Advisory board from world wide

International Collaboration

Global Quantum Conference

Quantum Sensors/Imaging R&D Detail

Core Tech. R&D for National Strategic Purpose and Advancing Industry Tech.

National Strategic R&D

Quantum Acceleration Sensor base on atom interferometer

Quantum Ghost Imaging System using arrayed photon detectors

Advancing Industry Tech.

Solid State Quantum Sensor for Magnetic Resonating and Wide Area Magnetometer

Reliabilities in Quantum Sensor

Quantum Photon Source for Reliable Operation of Quantum Sensors

Enhancement of Reliability Assurance in Quantum Metrology

Quantum Communication R&D Details

Core Tech. for Integration and Advancing Communication

Integration in QKD Devices	Advancing Device Tech.	Long Range Tech.

Chip scale QKD transponder for fibered QKD system

Integration of Entanglement Photon Source and Photonic Interference Device

High Efficient SPAD gate operating freq. of GHz

Trust node between different QKD protocol equipment

Thank you.

Q & A