FY2019
R&D Strategy
Briefing

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FUJITSU
shaping tomorrow with you

Trust, Digital and Global

I am Hirotaka Hara of Fujitsu Laboratories. In light of what Hidenori Furuta has told you about the Fujitsu Group's R&D strategy, I will talk about the initiatives of Fujitsu Laboratories.

We are focused on three points: Make Trust, Lead Digital, and Act Global, and I will talk about each of these, in turn.

The first is making trust. We believe that trust is essential in achieving a digital transformation. In the case of ICT, what was important was reliability: executing transactions quickly and accurately. Of course that is important, but in the digital era what is needed in a broader sense is trust.

Achieving Digital Trust

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Fujitsu Laboratories ensures "Trust" by technologies for solving various customer issues in the digital era

Collaboration
Compliance
Governance
Contract
Smart contract
Authentication (Corporate/Person)
Data Traceability Management
AI
Cyber security
Social Responsibility
Authentication
Domain-Specific Computing
Rules/Regulations GDPR
Explainability
Risk Management
IoT
Eligibility
Safety
Immediacy
Trust
Reliability
Accountability
Information Ethics/Morality

In this diagram, inside the circle is cyberspace, and outside of it is the real world. Inside cyberspace are factors that comprise trust ensured by technologies, including cyber security and privacy, of course, but also such factors as explainable artificial intelligence. In the physical space of the real world, as well, ensuring compliance and data protection, such as following the EU's General Data Protection Regulation, is what leads to trust.

Cyberspace

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"Trust" in all kinds of transactions
Implementing cyberspace
which can be used by all of stakeholders safely

In the digital era, all kinds of stakeholders are actively conducting a variety of business in cyberspace. Accordingly, it is essential to create a cyberspace that everyone can use safely and efficiently. I want to give two examples.

The first is managing personal data and, in particular, one's identity. I think we all have difficulty in managing many types of IDs we have. IDXY is the integrated management technology using blockchain to enable the safe and secure use of personal data. For example, when you change your address, with IDYX you can do it in one step in a way that is safe and takes your privacy into consideration. As we announced in an October 10 press release, we are planning a field trial of IDYX with JCB Co. Ltd.

The second is the Marunouchi Data Consortium, a collaboration with Mitsubishi Estate. This is a platform that enables companies from different industries to use each other's data to create new services and businesses in the Marunouchi area of Tokyo. What is important here is a system for the safe and secure exchange of data. We are providing a data management platform using blockchain technology called Virtuora DX. This is also one form of trust for the digital era.

In addition to IDYX and Virtuora DX, Fujitsu Laboratories is providing Dracena and other cutting-edge technologies for data management.

Turning now to physical space, it is increasingly important to satisfy people with the trust they seek in human society. Anchoring that trust are such things as laws and contracts, but now there is also a lot of attention being drawn to the issue of AI ethics, which is what I would like to talk about now.

How to address AI ethical problems

Collaboration with AI4People in Europe > Fujitsu Group AI Commitment

Nov. 2018 — "Five ethical principles for AI"
Framework of European Commission's AI ethics guideline

Mar. 2018 — "Five principles to address AI ethical problems"

Fujitsu Laboratories is one of founding members

1. Provide value to customers and society with AI
2. Strive for Human Centric AI
3. Strive for a sustainable society with AI
4. Strive for AI that respects and supports people's decision making
5. As corporate social responsibility, emphasize transparency and accountability for AI

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Fujitsu Laboratories has vigorously been working on the issue of AI ethics. We were a founding member of AI4People, Europe's largest forum for AI-related ethics, and have been a leading voice in discussions about this issue. The "Five ethical principles for AI" announced by AI4People provided the framework for the European Commission's AI ethics guideline. Building on this experience, in March of this year we announced the five principles of our own Fujitsu Group AI Commitment. While they are very simple, they are important points to be conscious of when designing AI systems. This is the ethical AI we want to create.

How to address AI ethical problems

Established the "Fujitsu Group External Advisory Committee on AI Ethics"

Aiming to reflect the objective opinions and ideas in the Fujitsu Group AI Commitment

> Specialists from diverse fields are appointed

Junichi Tsujii	Fellow in Information Technology and Human Factors, and Director of the Artificial Intelligence Research Center at the National Institute of Advanced Industrial Science and Technology, with concurrent positions as professor emeritus at the University of Tokyo and professor at the University of Manchester	Takanori Takebe	Professor, Institute of Research, Tokyo Medical and Dental University Director, Communication Design Center, Yokohama City University Deputy Director, Organoid Center, Cincinnati Children's Hospital
Yuko Kimijima	Professor (of Intellectual Property Law), Keio University Law School	Kumiko Bandou	President, Japan Legal Support Center
Hiroko Kuniya	Independent Journalist Trustee (Special Mission), Tokyo University of the Arts	Takakazu Yumoto	Director, Primate Research Institute, Kyoto University Also a professor in the area of ecosystem conservation in the field of Ecology and Social Behavior Titles omitted

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As one initiative, we established the Fujitsu Group External Advisory Committee on AI Ethics, which recently held its first meeting, and I also attended. We have wonderful outside experts participating in this committee. This is an opportunity for us to hear a range of opinions, drawing our attention to issues that had not occurred to us, and occasionally giving us severe feedback. We want to use these valuable insights to develop safe and secure AI that will benefit society.

The second point is to lead digital. Fujitsu Laboratories wants to become the laboratory that produces the world's top digital technology.

Technologies supporting DX

- Concentrating resources in 7 key technology fields

Computing
Digital Annealer, HPC

AI
Explainable AI, Wide Learning

5G
Local 5G, network slicing

Virtual world (digital space)

Value

Collection

Real world (Physical space)

Cyber Security
Multi-factor biometric authentication, Security by design

Cloud
Hybrid cloud and/ multi-cloud

Data
Virtuora DX, Data Lake, Chain Data Lineage

IoT
Dracena, edge computing, real-time digital twin

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As Hidenori Furuta explained earlier, we are concentrating our R&D resources in seven areas of technology that support digital transformations. Fujitsu Laboratories plays a central role in these areas, but today I would like to talk about two of them: computing and AI.

I will talk about computing first. Fujitsu develops leading supercomputers, such as the K computer and the upcoming Fugaku, and takes pride in being one of the world's top vendors of computing technology. Recently we developed the Digital Annealer, a new computing technology inspired by quantum phenomena, and we take pride in the fact that this technology is the most advanced practical implementation for solving complex combinatorial optimization problems. Later I will talk about Content-Aware Computing, an innovative computing technology that we are announcing today.

I will give one example of a project involving the Digital Annealer. We issued a press release on this in September of this year, describing the joint research we have started with PeptiDream Inc. PeptiDream Inc. has high expectations that, with the Digital Annealer, drug discovery will become tenfold faster than before. We hope to have some good news to announce in the near future.

Next I want to talk about cutting-edge AI technology. We have been researching the field of AI for over 30 years. In the AI patent application ranking in Japan announced in July 2019 by the Japan Patent Office, Fujitsu ranked second, and this is one piece of evidence of our technological capabilities. We have also been putting a lot of effort for some time in explainable AI, in particular. A technology called Wide Learning not only makes predictions; it explains why it made the predictions, and even presents action plans. We are proud of this innovative technology that no other company has. In the practical implementation of AI, another important issue is the quality of AI. Today we are announcing a technology called High Durability Learning.

As shown on this slide, the issue of AI quality is quite varied. Fujitsu Laboratories is working to resolve all kinds of problems, including everything from upstream issues, such as how to prepare the data, to issues that arise once AI is in operation, such as performance monitoring and relearning. For example, when monitoring performance once an AI is operational, a problem can arise in actual operations in which the precision of the AI model deteriorates. Today we are announcing a new technology that automatically resolves this problem.

The third point is to act global. We seek to be a leading global laboratory.

Fujitsu Laboratories already has a global organization. In addition to Japan, we have locations in the US, China, and Europe. We have promoted an approach to R&D in which each location leverages its unique capabilities for each research topic, but given the scale of the organization, Japan plays the leading role in advancing research. We are thinking of implementing a chain of command in the locations that works best for the leaders of each research topic. In the future, we seek to be a truly global laboratory that advances R&D with each of the four locations having equal status.

Both inside and outside Japan, Fujitsu Laboratories is pursuing open innovation by collaborating with the best partners in each technology field.

This slide shows six representative examples. With the University of Toronto in Canada, we are working together on the Digital Annealer, from basic research to applied research. With inria in France, we are doing joint research in the field of topological data analysis. Inrai is one of the world's top mathematical research institutes. In addition, we have produced a variety of research results in collaboration with other partners, such as the Technical University of Munich andRIKEN in Japan.

Human resource management strategy specific to our laboratories

In working globally, it is important to be able to attract top talent. As stated in President Tokita's recent Management Direction briefing, Fujitsu has a plan to strengthen its strategy for recruiting, training, and retaining talent, but Fujitsu Laboratories plans to take the lead in recruiting top to experts. As you know, in the ICT field, particularly in the field of AI, it is becoming very difficult to recruit talent. We are creating separate career tracks for the treatment and development mechanisms for top experts, and through selective position appointments for existing employees and by hiring the world's top engineers, we seek to build the ranks of these highly-skilled professionals.

On this slide we introduce some of the top researchers at Fujitsu Laboratories. We want to create a global laboratory to enable them to thrive and enable us to attract top outside talent.

Here I would like to talk about the activities of our young researchers. The Japan Science and Technology Agency has a program called ACT-X for young researchers who are selected to represent Japan. The acceptance rate is extremely low, but among private sector companies only Fujitsu Laboratories has had three young researchers selected for this program. We want to create an environment in which young researchers can stretch their talents in their research, and where talented employees can thrive and produce exceptional results.

I have talked about the three points of Make Trust, Lead Digital, and Act Global.

New technologies
will be announced today

Today we are making two new announcements.

The first is High Durability Learning, which is the world's first technology to resolve the problem of a drop in precision when an AI is put into operation.

The second is Content-Aware Computing, which is an innovative technology that, while a computer is running, inspects the content of the data and automatically checks processing performance.

This concludes my presentation. Thank you for your attention.