# Leading Innovation with Japan's Information Technology

Japan has one of the highest levels of mobile broadband in the world, with 4G wireless mobile telecommunications networks covering 99% of the population. There are more than 140 mobile broadband subscriptions in place for each 100 people in Japan, demonstrating the Japanese people's avid participation in this market. Japan has been trying to exploit this advantage so as to lead the world in innovation based on information technology (IT). Professor Jun Murai of the Faculty of Environment and Information Studies at Keio University explains, "Japan is a unique market with high quality and safety demands from consumers, which have led to rapid advances in the quality of products and services. One of Japan's strengths is high-precision manufacturing, as typified by the automobile industry. In IT, Japan's advantage is in its network infrastructure, one of the most advanced in the world. Having this environment in place provides a huge tailwind propelling innovation in the Internet of Things [IoT], which combines physical objects and IT."

Mobile Broadband Subscriptions per 100 Inhabitants, June 2016

Note: Data for United States is an estimate.
Source: OECD Broadband Portal.

A current area of particular focus for Professor Murai is the application of IoT to agriculture. In agricultural IoT, factors in the crop-growing environment—including plant growth, soil moisture, air temperatures and humidity, and sunlight—are graphically displayed and analyzed. This enables efficiencies in the application of fertilizer and pesticides and the harvesting of crops. Full-scale adoption of agricultural IoT may lead to increased income for producers and encourage new people to enter the field, alleviating the shortage of young farmers, which is severe issue in Japan. IoT will extend to agricultural equipment, expanding future export markets for Japan's advanced agricultural technology through IoT equipment exports. The use of IoT also holds promise in helping to solve the world's food problems.

Professor Murai is also interested in the potential for change in the manufacturing sector with the shift from mass production to individual production based on the rise of digital fabrication, typified by 3D printers. As he notes, "With the accumulation and sharing of knowledge powered by IT, it is becoming possible for anyone to turn out products that could previously be made only by companies." Instances of the use of 3D printers are increasing in Japan as elsewhere. One example is a Japanese start-up that is developing electrical prosthetic arms and has begun to open-source its design data for 3D printers. Not only will this lead to electrical prosthetic arms that are much less expensive than before, but it will also allow people to modify designs and improve functionality themselves. This approach will raise the overall level of these products by drawing on collective intelligence rather than keeping the technology within a single company, and it may bring about a revolution in the field of electric prosthetic arms.

Professor Murai has high hopes for innovation using IT born in Japan. "To play a leading role in the expected fourth industrial revolution, we need to show the world new technological achievements in various fields. Japan has built an environment that supports the quest for innovation through collaboration among industry, academia, and the government, and we in the academic world want to play a leading role in this quest," he says.
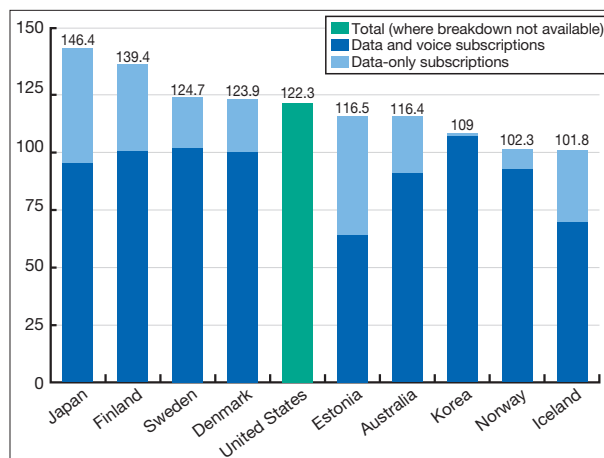
1. Sensors set in fields collect data on temperature, humidity, sunlight, soil moisture, CO_2 levels, and other environmental factors. This data is stored in the cloud and can be checked from personal computers, tablets, and smartphones. The system also includes a feature allowing users to navigate through the measures to be taken when conditions change suddenly while crops are growing. It is a step toward the realization of IoT agriculture based on scientific findings.

2. An IoT agricultural machine: A combine harvester is equipped with a "yield sensor" that measures weight and a "taste sensor" that measures the water content rate and protein content rate, which greatly influence how rice tastes, during harvesting with rice still in its husk. By analyzing this data, growers can adjust the amounts of fertilizer and other inputs in the following years.

A man fitted with an electric prosthetic arm shakes hands with a visitor at an exhibit in the United States. An open website for developers has become a forum for lively exchanges of ideas on how to improve the prosthetic device.
Photo: exiii Inc.

Jun Murai

Professor and Dean, Faculty of Environment and Information Studies, Keio University. Born in 1955 in Tokyo. Has contributed greatly to the development of the Internet in Japan, founding the JUNET computer network linking universities in Japan via telephone lines in 1984 and launching the WIDE Project for research on the Internet in 1988, among other activities. Known as the "the father of the Internet in Japan" and "Internet Samurai" for his achievements in the field. Appointed Chairman of the IoT Acceleration Consortium in 2015. Has served as a member of the Japanese government's IT Strategy Headquarters since 2000.