Message from the CTO/CMO, and Technology Introduction

Supporting next-generation growth through innovation and rapid commercialization, and contributing to the realization of a sustainable society

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R&D and innovation strategies

At Panasonic, we are engaged in R&D and strategies that create innovation with an eye to the future so that we can keep contributing to "A Better Life" and "A Better World" through our business activities.

Looking at the business environment that envelops the Company, the spread of novel coronavirus disease (COVID-19) in 2020 had an enormous impact worldwide, which in turn triggered the rapid adoption of measures in the virtual world, such as teleworking, online learning, and remote medical care. The evolution of digital technology is currently having a profound effect on the real world and we continue to carry out our own historic changes and create innovation with the goal of turning the unprecedented challenges brought on by COVID-19 into the cornerstone of our development.

The Science and Technology Basic Plan drafted by the Cabinet Office of Japan calls for "Society 5.0," a new future society that Japan should aspire to. The concept incorporates IoT, robots, artificial intelligence (AI), and other cutting-edge technologies to provide goods and services that meticulously address a diverse range of needs, thereby aiming to realize a society that balances economic development with solutions to the issues it faces. Digitalization and the uptake of IoT is taking place in a multitude of fields as the world we live in rapidly transitions from an industrial society to an information society, and then finally to a super-smart society advocated for by Society 5.0. We expect these changes in society to gather increased momentum up ahead as a result of the spread of COVID-19.

To survive when faced with dramatic change, we must transform our overall business process so that we remain in step with the times. Previously with mass production, products became independent of their manufacturers as soon as they were shipped from the factory. However, in the era of IoT, where all kinds of things are connected to the Internet, we will be able to continue offering contributions by maintaining the connection between manufacturer and customer through products and services even after shipping.

To this end, simply aiming to have most of our customers feel completely satisfied when providing a product or service is unlikely to be good enough. We feel that we must offer ways to update these products and services while they are still being used so that they become the "most suitable" for each and every customer. In a sense, this is an attempt to rebuild the traditional bonds between a neighborhood store and its community in a way that the current times demand. By moving quickly to build and expand the software-hardware integrated business model unique to the manufacturing industry, we will aim to leverage our broad-ranging technological and manufacturing capabilities accumulated thus far to create value for our customers.

On top of this, we will also need to drastically change our approach to product quality so that it aligns with our business process. If we are to provide updates to products and services after they have been sold and delivered to customers, we will most likely need to continuously meet the after-sales requests of customers with a level of quality that exceeds that at the time of original delivery. We intend to steadily work on building such a system going forward.

In addition, we will be required to change the very way we engage in technological development. In times when our target customers were the general public, we were

expected to have the technology to mass produce "perfect" products. However, in the age of IoT it is possible to target a "specified and large number" of customers, so in order to reach out to a certain customer segment and deliver value, having a framework that is conducive to speed and co-creation with external partners will be paramount. In other words, we must reinvent our technological development and manufacturing processes. Demanding perfection from engineers from the outset, as was the case in the past, actually impeded innovation because of the restrictions they had to work under. To foster a culture that is always innovative, we must be ready to purposefully allow "imperfection" going forward. For example, if we quickly release a trial product to our customers, we could then go about further improving it together with customers.

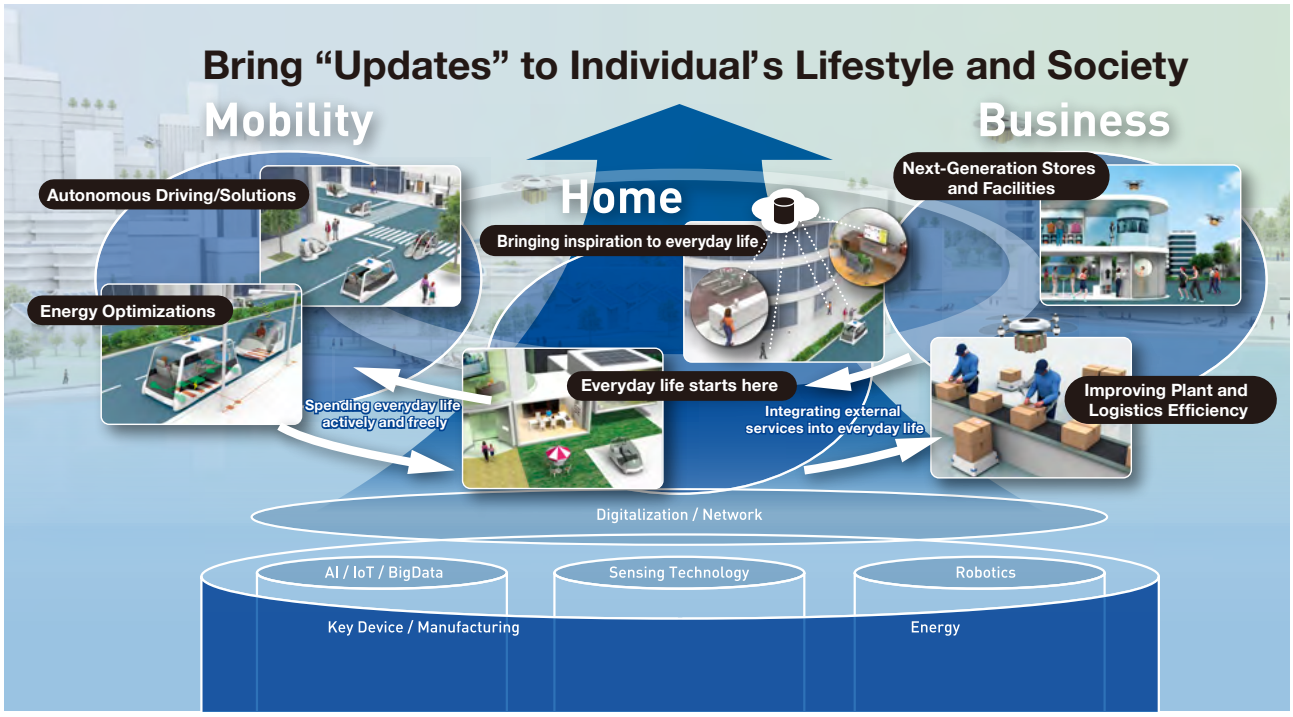
In 2017 we established a Business Innovation Division and since then we have pushed ahead on creating a culture of innovation by setting up flexible and cross-sectional organizational units. Then in 2020 we set up a Lifestyle Business Strategy Division under the direct control of Panasonic Headquarters with the aim of creating a forward-thinking, user-oriented services businesses. Possessing business strategy and corporate management know-how, as well as Company-wide, cross-sectional collaboration functions for technologies and products, this Division has in place a structure capable of pursuing the launch of new businesses.

Under the umbrella of the Innovation Promotion Sector we established a Technology Division. This Division brings together the departments each tasked with technological development of software as well as devices and other hardware. Also, the Division will aim to deliver ongoing updates in conjunction with our Lifestyle Foundational Technology Center, which is responsible for developing the technological frameworks and systems geared towards improving software. To go into more detail, the Division will continue to focus mainly on AI-driven innovation in digital technology, and innovation in materials development, the sharpening of the competitive edge of devices, and the development of sensing technologies, robotics, and software, which meet customer needs. In this way, it will support, from a technological standpoint, our *Gemba* (operational frontlines) process and other initiatives to expand the contributions of our products and services. Furthermore, we have newly established an Energy Business Development Office to take charge of creating new businesses centering on sources of energy that contribute to the attainment of sustainable growth. This office will look to undertake projects on a Company-wide and cross-sectional basis.

We will advance our initiatives for technological development and manufacturing to the next phase—namely, giving shape to "Lifestyle Updates" and stregthening our software business, and support the growth of next generation businesses through innovation and rapid commercialization.

R&D Outlook

Our brand slogan, "A Better Life, A Better World," represents what we think to be our mission in society; namely, creating a better life and contributing to the happiness of people around the world, to the development



Please refer to "Technology & Design" on our website. https://www.panasonic.com/global/corporate/technology-design/vision.html

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of society, and to the future of the globe. This thinking is also consistent with our approach to the development of technology, which is why we are formulating a course of action for R&D that is focused on future businesses so we can contribute to a better life and better world and continually create technology that brings "Updates" to individual's lifestyle and society.

We have identified the following three key areas in which we will rise to the challenge of continuing to provide contributions, or in other words, bringing "Updates" to individual's lifestyle and society, by further evolving the technologies we have honed thus far and combining them with AI and other digital technologies: (1) home—the foundation of all lifestyles; (2) mobility—concerning the movement of people and goods; and (3) business—stores, facilities, plants, etc. which support people's lifestyles.

Contributing to the realization of sustainable society

The industrial societies that developed as a result of the industrial revolution provided the world with material wealth and dramatically improved people's livelihoods, but at the same time they seriously affected the global environment. We believe it is also our mission, in terms of technological development, to use technology to find solutions to the detrimental effects that technology has brought on the environment. Not only do we adopt measures to conserve energy in our own operations, but we have been engaged in the business of mainly fuel cells and storage batteries, which contribute greatly to the electrification of vehicles. Up ahead, we will work towards realizing the Panasonic Environment Vision 2050 (Please refer to "Message from the Environmental Compliance Administrator."), which mainly outlines our response to climate change, by designing energy-saving products in order to reduce the amount of energy used, by refining battery technology and developing hydrogen energy technology, to further increase the energy created and its efficient usage.

We are establishing global partnerships with each supplier around the world. We will aim to establish fair, impartial, and sustainable supply chains by sharing with suppliers our values pertaining to not just economic aspect, but also the environment, CSR, and relationship with society. (Please refer to "CSR Procurement.")

Technological and manufacturing capabilities accumulated in consumer electronics

Since its establishment as a manufacturer of wiring equipment in 1918, Panasonic has continued to expand the scope of its business operations, mainly in the area of consumer electronics. Our major strengths are the wide-ranging technological capabilities and know-how accumulated and refined through manufacturing that is always conscious of our customers.

We have produced a multitude of products that make society better and more convenient by skillfully combining and amalgamating advanced technologies in a wide variety of fields, from visual/imaging and audio/voice to mechatronics (mechanisms), materials/devices, and even energy.

We cannot, however, produce superior products through technological capabilities alone. Cutting-edge manufacturing capabilities are indispensable in the utilization of technology for improving performance, quality and usability. For instance, know-how relating to coating, molding, measurement, mounting, machine processing, control, CAE (simulation) and quality control, as well as the adjustment and integration of technologies that interconnect these processes. These manufacturing capabilities are another major strength that Panasonic has cultivated, and their importance will remain unchanged even in the era of AI, IoT, and robots.

At Panasonic we have two key strengths: technological capabilities and manufacturing capabilities. The former spans a wide range of fields, while the latter enables us to make products in a reliable fashion. By leveraging these capabilities, we intend to promote innovation and create new businesses that offer the "most suitable" products and services to each and every customer.

Examples of products that have improved Panasonic's technological capabilities and manufacturing capabilities

1927
Launches National Lamp

1950
Launches Company's first car radio

1952
Company's first black & white TV

1958
Launches Company's first household tape recorder

1961
Launches first Matsushita home

1963
Launches "National Hi-Top," world's longest-lasting dry cell battery

1968
Develops first "Panasert" automated resistor mounting machine

1978
Launches Panasonic's first compact office computer (PC)

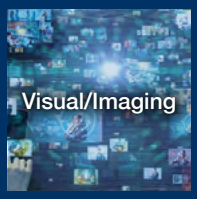
1988
Launches Panasonic's first electronic still camera

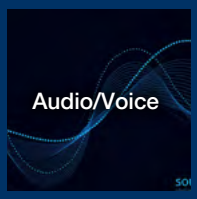
1996
Launches industry's first digital mobile phone weighing less than 100 grams

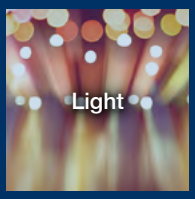
2010
Begins mass production of HEV lithium-ion batteries

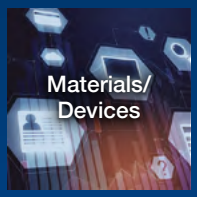
2017
Develops facial recognition gate, put into operation at Tokyo International Airport

Various technological capabilities we have hitherto honed and developed in mainly visual, audio, and optical fields

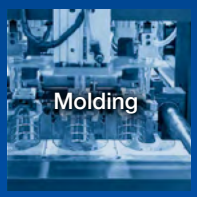


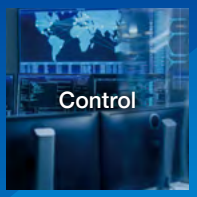






Manufacturing capabilities in mainly coating, molding, measurement, and mounting processes that produce reliable and safe products





A Better Life, A Better World

Technology Introduction

Achieving a safe and secure society in the IoT era by enhancing industry-leading Cybersecurity technology

Panasonic has led many aspects of security technology for more than 30 years, including encryption, authentication, and tamper resistance to prevent hacking of audio visual products and connected appliances.

In the era of the Internet of Things (IoT), Cybersecurity has rapidly grown in importance as a way of safeguarding PC and IT systems. We are evolving our security technology further in the IoT Cybersecurity field for application in factories, buildings, automotive solutions, and homes.

Growing threat of cyber-attacks

The number of observed cyber-attacks are increasing and half of such attacks targeted IoT devices in 2019 (see figure below). The World Economic Forum published its "*The Global Risks Report 2019*," highlighting cyber-attacks against key infrastructure and data fraud/theft as "global risks" likely to cause serious damage throughout the world in the next decade.

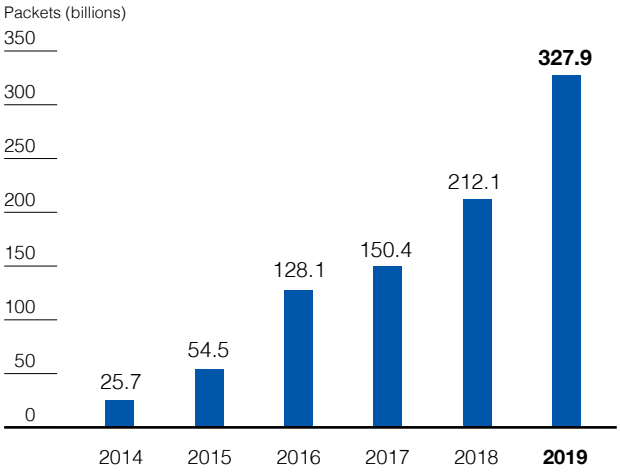
Under such circumstances, we are also anticipating a greater Cybersecurity risk in our business area. For example, in the smart factory and smart building area, network-based operations heighten Cybersecurity risk. In the automotive area, connected vehicles and driving assistance systems, including ADAS functionality, contribute to fewer traffic accidents, however, their vulnerabilities allow unauthorized remote operations, which can lead to recalls. These types of cars require security countermeasures in our business area.

Panasonic Cybersecurity initiatives

For more than 30 years, Panasonic has led many aspects of security technology, including encryption, authentication, and tamper resistance to prevent hacking of audio visual products and connected appliances.

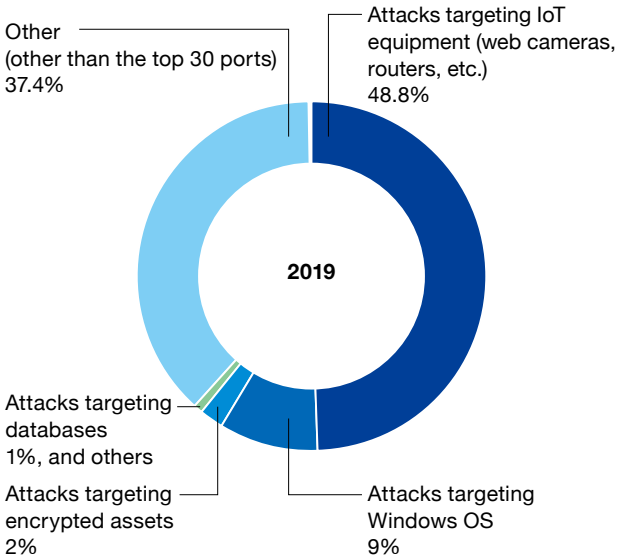
Recently, Panasonic has focused more on IoT Cybersecurity technology such as connected factories, buildings, automotive solutions, and homes. This technology monitors data flow over networks to judge abnormal behavior as a cyber-attack by utilizing cutting-edge AI, and prevents not only known attacks, but also unknown attacks.

Number of observed cyber-attacks by NICTER's darknet sensor*



*NICTER (Network Incident analysis Center for Tactical Emergency Response) is a network for monitoring cyber-attacks, operated by the National Institute of Information and Communications Technology (NICT)

Breakdown of observed cyber-attacks by NICTER's darknet sensor



Source: Cybersecurity 2019, Cybersecurity Strategic Headquarters of the Japanese government

We are currently conducting proof of concept (PoC) on multiple fronts to analyze huge data logs and to detect abnormalities. Our incident response team demonstrates the capability to discover security holes before attacks occur and minimize damages even if an incident has occurred in the PoC.

We are moving towards the commercialization of IoT Cybersecurity technology by improving capabilities through these PoCs with Mori Building Co., Ltd. and Tokyo Tatemono Co., Ltd. in smart buildings and remote automotive monitoring field trials with mobility partners.

Highly recognized security technology

Panasonic Cybersecurity technology has been highly recognized in the industry. We presented our research achievements at the world leading automotive security conference "escar" and the ICS security conference "S4" in 2015, 2017, and 2019. In 2020, our research was presented at "Black Hat," the most prominent Cybersecurity conference since 1997. These achievements show that Panasonic commands the leading position in the Cybersecurity industry.

Panasonic aims to provide "Lifestyle Updates" that deliver the best option to every customer by continuously improving our products and services after sale. We position Cybersecurity technology as a core technology that supports our "Lifestyle Updates" in many business areas such as factories, buildings, automotive solutions, and homes. This technology is not only applied to our current products or services, but also provides innovative Cybersecurity solutions to customers, such as "security consulting services," "security monitoring services," and "intrusion detection software," which contribute to a safe and secure society in the era of IoT.

Panasonic initiatives in Cybersecurity Solutions