

DOCOMO's R&D has been leading the mobile scenes not only in Japan but the world over. It has continuously created new technologies and new services by exercising its creativity and innovativeness. We strive each day in our R&D toward sustained growth in the 2030s by “providing new value for customers” and “solving serious social issues.”

Promoting R&D and Innovation

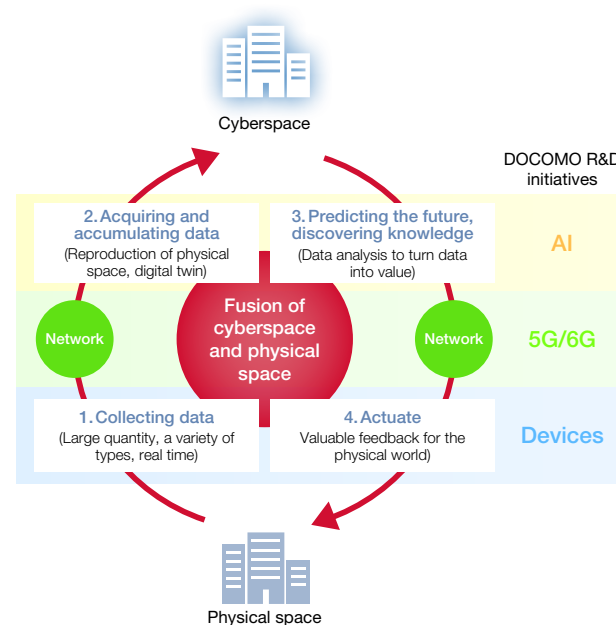
Basic Policies and Philosophy

Innovation in industry and technology, known as the fourth industrial revolution, continues apace around the world, particularly in the realms of the Internet of Things (IoT), Big Data, artificial intelligence (AI) and robotics, leading to the generation of new economic value. Meanwhile, many social issues have emerged, including the declining birth rate and the aging population, as well as dealing with the new normal. In this social environment, DOCOMO R&D is working “to fuse cyberspace and physical space,” where humans, objects and events in the physical world are digitalized, the future is predicted and the real world is optimized. Specifically, DOCOMO is researching and developing as follows.

1. “AI” that connects a variety of data, predicts the future and discovers knowledge
2. “5G/6G,” which connects everyone and everything everywhere
3. “devices” that gather information and provide a range of feedback.

In addition, we are accelerating open innovation with external corporate partners. Through these activities, we will achieve social and industrial development through information and communication technology (ICT), while solving social issues and providing new value for customers and our partner companies.

R&D Initiatives for Fusing Cyberspace and Physical Space



R&D System

DOCOMO conducts R&D on mobile communication systems and new products and services primarily at the Yokosuka Research Park. The R&D Division leads our efforts, while the R&D Strategy Department is responsible for overall supervision. As part of our ongoing R&D activities and to further enhance the Group's devices, networks and services, each R&D division collaborates with other divisions. We also conduct joint development with major manufacturers toward realizing ideas for new services conceived by business divisions and promote an open innovation strategy that maximizes our diverse relationships with external entities. We publicize the results of our R&D efforts, such as new technologies, by making strategic announcements to the media and in other ways.

In response to global technological innovations, we have established R&D bases in the U.S., Germany, and China. These bases particularly contribute to international standardization activities for 5G and virtual network technology in collaboration with the R&D Division at the DOCOMO head office. Along with DOCOMO Innovations, Inc. and the Silicon Valley branch of NTT DOCOMO Ventures, Inc., we also collaborate with and invest in startup ventures in North America, with the objective of investing in startups possessing advanced, innovative technologies that can be applied to mobile communications services.

R&D Innovation Division

R&D Strategy Department

Common planning and management related to R&D and technology innovation, global technology alliances and technical publications

Innovation Management Department

Business creation, strategic investment and corporate collaboration related to technology innovation

X-Tech Development Department (formerly Research Laboratories)

R&D, installation support and technical support related to digital infrastructure

6G Laboratories (formerly 5G Laboratories)

Method research and standardization related to wireless and network systems and co-creation of use cases

Communication Device Development Department

Development, installation support and technical support for terminal devices and applications

Service Innovation Department

Development, operation, maintenance and technical support for methods and cloud systems related to new services and solutions

Core Network Development Department

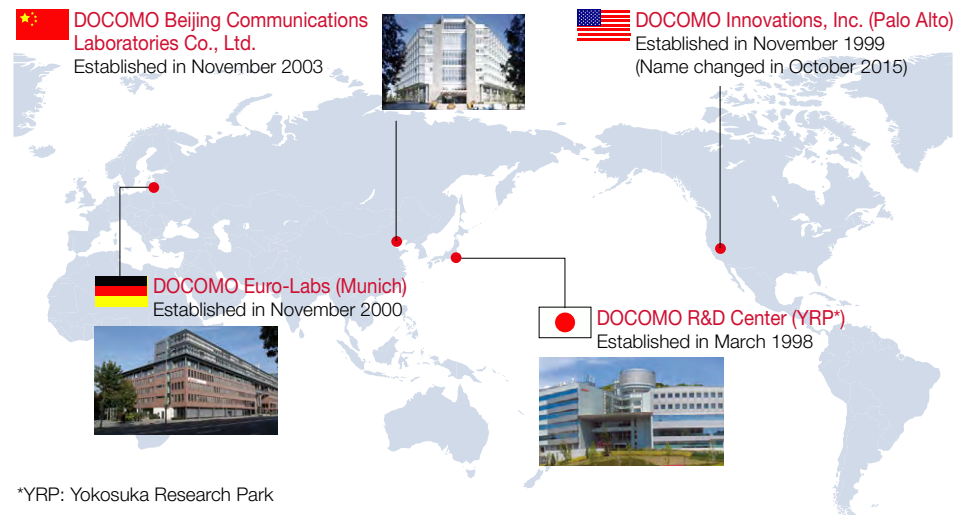
Development, installation support and technical support for core network systems

Radio Access Network Development Department

Development, installation support and technical support for wireless network systems

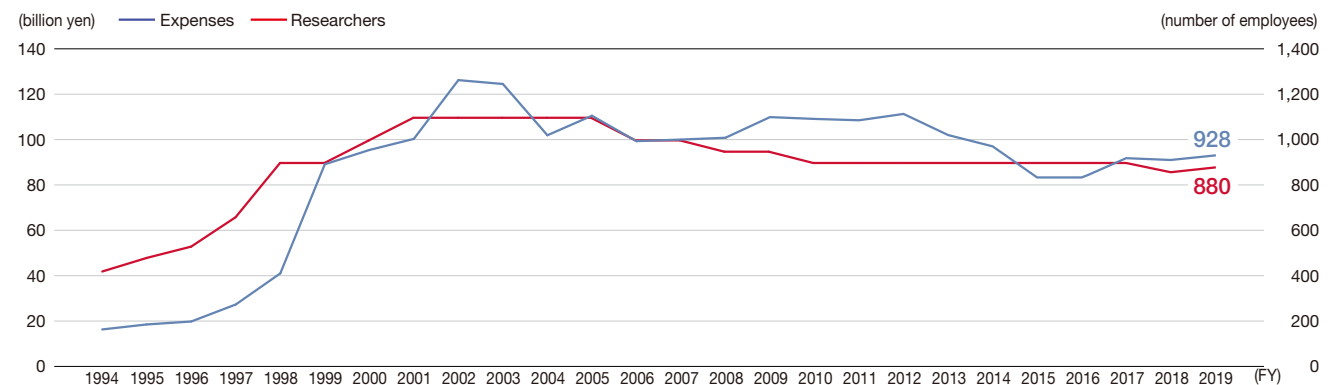
R&D General Affairs Department

General affairs, accounting, technology information management and technical publications for the R&D Division

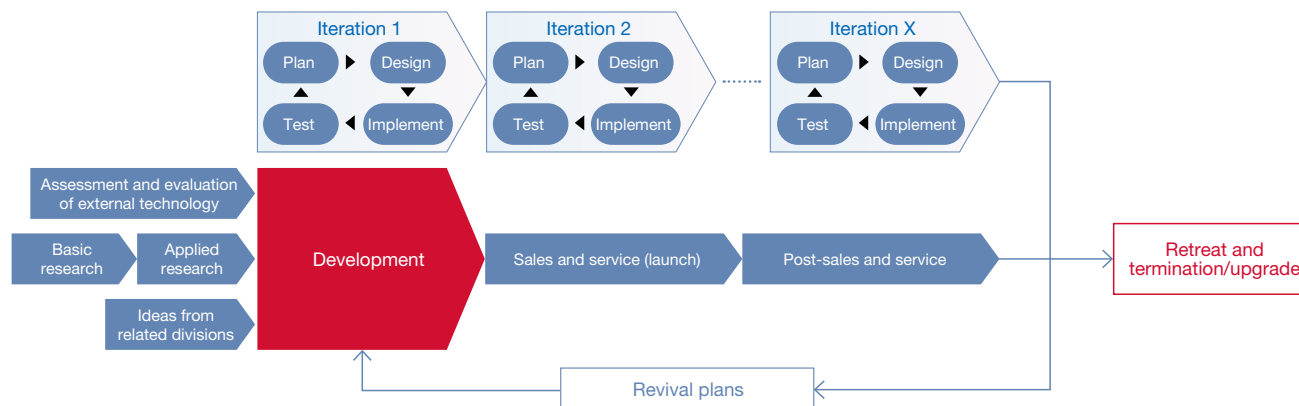


Changes in R&D Expenses and Number of R&D Employees

Since the late 1990s, we have maintained a workforce of between 900 and 1,100 researchers for research and development and have spent around 80 billion yen to 100 billion yen annually from the year 2000. We continue to lead in the global mobile communications business and provide innovations that serve as the backbone of sustainable development.



Innovation Chain



Basic Research

DOCOMO, as a major operating company of the NTT Group, supports NTT's R&D system for basic technologies. The R&D divisions of NTT and DOCOMO maintain close cooperation in their research to ensure that DOCOMO's business activities benefit from technological achievements made through these efforts. As an example of how we have applied such technological achievements, the laboratories of the holding company conducted basic research on voice recognition and intention interpretation technologies, which were then moved to the applied R&D phase at DOCOMO. This has led to the creation of various new services in recent years.

Applied Research and Development

In the area of infrastructure, we engage in technological exchanges with major overseas operators, centered on 6G Laboratories, and formulate strategies in response to external trends. We are therefore contributing to the establishment of global standards and leading the industry in ecosystem-related

efforts by conducting PoC (Proof of Concept) experiments with major manufacturers. Even as we play a role in the advancement of this industry, we also ensure that we enjoy competitive advantages in developing our own businesses. Furthermore, the Core Network Development Department and the Radio Access Network Development Department are heading up our involvement in joint development with major manufacturers to provide equipment and systems with internationally recognized functions.

As for services, service ideas created by the business divisions are taken up by the Service Design Department to develop system infrastructure, while the Communication Device Development Department develops applications installed on the device. The Innovation Management Department is responsible for creating businesses related to technological innovations, extending strategic investments and bolstering collaboration with other companies.

The Service Innovation Department develops element technologies and systems related to the creation of new

services and strive to create new offerings by establishing an agile development system to promptly respond to market needs. The X-Tech Development Department works closely with the business divisions to develop a technological platform that meets the business. As we create services, we accelerate the pace of introducing them and their value to markets by incorporating element technologies developed by NTT and the latest technologies developed elsewhere, in addition to DOCOMO's own technologies. Furthermore, we are striving to further expand into new markets for services based on DOCOMO technologies.

Sales and Service

Relevant divisions at DOCOMO actively present proposals that reflect social conditions, trends in technological development, and circumstances at shops as well as ideas for improvement from shops and the results of exchanges with external companies and customer marketing activities.

We convene screening meetings as part of our deliberations to launch new services. This cross-sectional meeting structure allows for our quick holistic decision making.

Post-sales and Post-service

Each business promotion division regularly monitors the situation of services and formulates revival plans for services that appear unlikely to meet their initial targets.

Promoting the Creation of Innovation

To accelerate the development of services that help address social issues, we create innovation by starting small. As the challenges faced by society and customers become more diversified and complex and as business competition intensifies, it has also become increasingly important to understand the locations where we do business in order to discover potential issues and needs and quickly turn them into solutions and profit. Adopting this small start method allows us to reach the commercial trial stage more quickly than by using a standard development process and more rapidly develop businesses that address social issues.

Collaborating with Startup Companies— 39works

Based on an open innovation strategy that leverages diverse relationships with external entities, the 39works program for “co-creative business development” organizes joint projects with external partners and together engages in BizDevOps, which encompasses the entire process, from planning and development to operations and maintenance. The program aims for a quick start of small businesses and nurturing them by repeating improvements of their service quality in accordance with market response through a high-speed PDCA approach.

Also, the program is inclusive and creates products and services that are better and more useful for people by continuously determining whether they fit the needs of markets and society. We launched 2 new businesses and 11 new services in fiscal 2019.

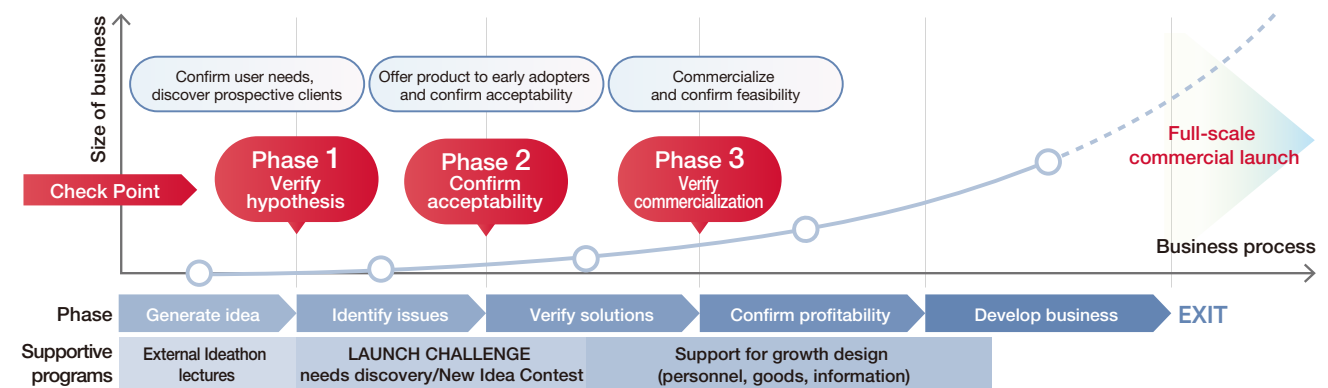
docomo LAUNCH CHALLENGE

docomo LAUNCH CHALLENGE is an initiative for commercializing new business ideas proposed by NTT DOCOMO Group employees with advice from a diverse group of mentors, each representing specialized areas of strength, such as entrepreneurs and designers, based on the insight gained from 39works. Each idea goes through a stage of considering which issues could be resolved by the business, verifying the real need, and determining the optimal solution while also reconfirming against feedback from the markets at every step. The ultimate goal is to instill confidence in each employee through the initiative, encouraging them to rise to the challenge of creating businesses that generate new revenue flow for DOCOMO or have an impact on society. In fiscal 2019, there were 173 applications, and verification is underway towards commercializing some of these projects.

In-House Venture System

The In-House Venture System of the DOCOMO Group serves as a means for encouraging the creation of new businesses by supporting employees who aspire to set up and manage an enterprise based on their own business concepts or technology. Business ideas submitted by employees are screened, and DOCOMO invests in ideas that passed the screening by establishing a company led by the employee who came up with the idea. During the screening process, the business idea is honed with the support of external mentors by conducting market analysis and verifying potential issues. Once a venture is set up, it continues to receive support from relevant departments of the DOCOMO Group as it seeks to grow. This system is intended to create businesses that provide synergies and impact for DOCOMO Group businesses.

Process of 39works



Promoting Open Innovation

DOCOMO is seeking to make the transition from a conventional mobile communications company to a “Value Co-Creation Company.” DOCOMO possesses diverse business assets such as its mobile networks and customer base, secure settlement systems and customer referrals. We believe that we can create new businesses by making these assets available to partners with expertise and knowledge, and this in turn will lead to the co-creation of new social values.

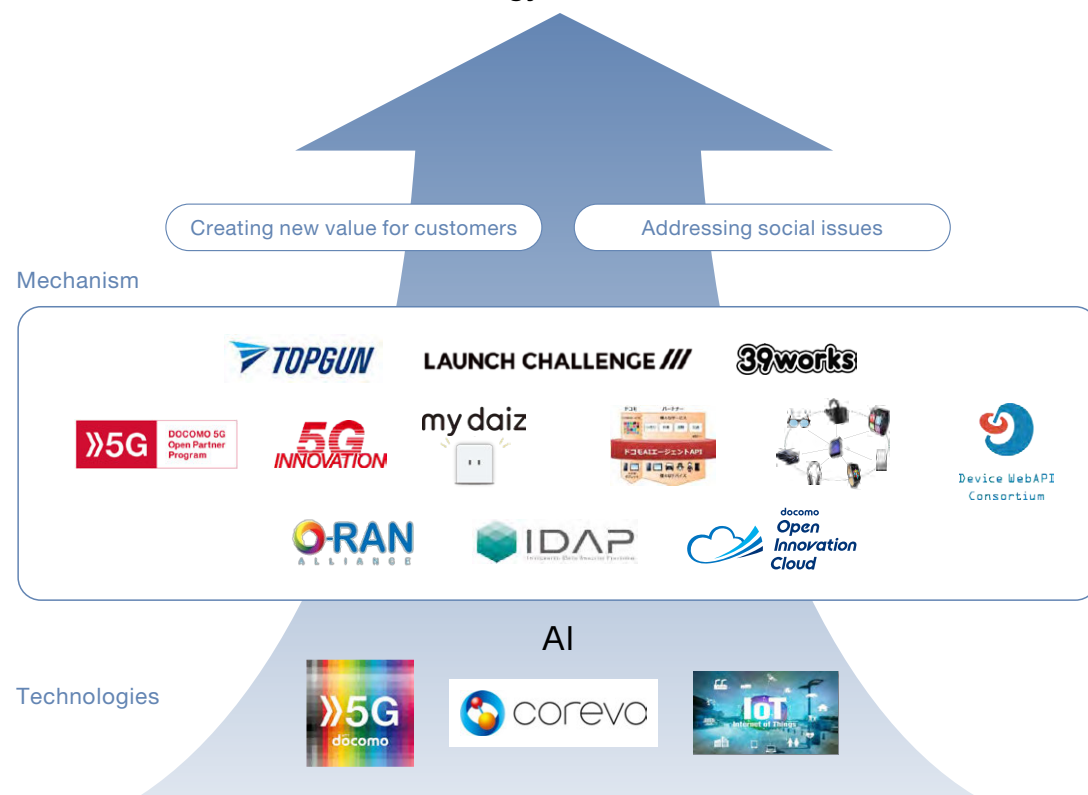
We will particularly focus on 5G, AI, and IoT, promoting co-creative innovation by applying various mechanisms to the technologies of DOCOMO and its partners to create new value for customers through the “+d” process while also seeking to address social issues. In the process of creating new businesses, we identify challenges facing customers, including social issues, and conduct trials with customers before commercializing the business and seeking growth. We offer diverse mechanisms for co-creative innovation, such as 39works (page 59), in which we nurture an idea from zero by conducting verification and commercialization with our business partners, and Top Gun (page 64), in which we proceed with verification and product development with our corporate customers.

As part of this initiative, the “DOCOMO 5G Open Partner Program,” launched in February 2018, will drive the development of new applications with a broad range of partners so that customers will be able to enjoy 5G services from the start of the 5G era. As of September 2020, more than 3,500 partners have joined the program. Furthermore, for those participating companies and organizations, we established DOCOMO 5G Open Lab, a permanent testing environment for 5G technology with 11 locations in and outside Japan (as of the end of September 2020). We also

constructed the “DOCOMO Open Innovation Cloud” as a testing environment connected to a cloud infrastructure. We are forging ahead with initiatives for creating new 5G applications in collaboration with a wide range of partners.

Mechanism for Promoting Co-creative Innovation

Promoting Co-creative Innovation through Technology × Mechanism



Co-Creation with External Partners

Through collaboration with partners in various areas, including local governments, companies, and research institutions, we will offer greater convenience for the daily lives of our customers and engage in initiatives aimed at revitalizing regional communities and resolving social issues. Specifically, we are pursuing “+d” initiatives in the areas of 5G, AI, and IoT.

Initiatives Undertaken with Diverse Partners in Principal R&D Projects in Fiscal 2018 and Fiscal 2019 (the following links are only available in Japanese)

Technology	Project	Alliance Partner	Initiative
5G	Fishery application by creating a 5G area at sea	<ul style="list-style-type: none"> University of Tokyo 	<p>The constant realization of large-capacity and low-latency communications enables remote monitoring in waters at any fishery. Constant remote observation of fishing grounds will improve the efficiency of workers in the fisheries industry and reduce their burden. We are moving ahead through demonstration experiments at fisheries with the evaluation of eMBB*1 and URLLC*2 and are promoting the demonstration of wireless technology that realizes the stable remote monitoring of fishing grounds.</p> <p>🔗 Successful demonstration experiment of remote monitoring of fishing grounds using 5G and underwater drone (PDF)</p>
	5G wireless communication experiment on the Tokaido Shinkansen	<ul style="list-style-type: none"> Central Japan Railway Company (JR Central) NEC Corporation Sharp Corporation 	<p>For the first time in the world, we conducted a successful 5G wireless communication experiment between the inside of a Shinkansen bullet train traveling at 200 km/h or more and the ground. The specific results are as follows.</p> <ul style="list-style-type: none"> Implemented ultra-high-speed data transmission that makes full use of the functions of both ground base stations and mobile terminals and successfully achieved a maximum data transmission speed of 1.0 Gbps or higher Succeeded in the continuous handover to sequentially switch three ground base stations to which the mobile terminal is connected; also succeeded in the high-speed download distribution of ultra-high-definition 8K video content from the ground base station to the mobile terminal via 5G Succeeded in the live relay of images from train windows through a mobile terminal to a ground base station via 5G using a 4K camera installed in an N700S train in a verification test <p>🔗 5G wireless communication experiment on the Tokaido Shinkansen (PDF)</p> <p>🔗 5G wireless communication experiment on the Tokaido Shinkansen</p>
AI	AI traffic jam prediction	<ul style="list-style-type: none"> East Nippon Expressway Company Limited 	<p>Started a demonstration AI traffic jam prediction experiment using demographics with the mechanism of the mobile phone network and past traffic jam results</p> <p>🔗 Notice: NEXCO EAST and NTT DOCOMO start traffic jam prediction demonstration experiment for the Tokyo Bay Aqualine (press release material)</p> <p>🔗 AI Traffic Jam Prediction on the Kan-Etsu Expressway</p>
	AI-operated bus	<ul style="list-style-type: none"> Yokosuka City Keikyu Corporation New Energy and Industrial Technology Development Organization (NEDO) 	<p>Operated on-demand shared “AI-operated bus” in areas with no bus routes in Yokosuka City as a demonstration experiment for improving residents’ convenience, promoting health, curbing social security costs, and revitalizing the local economy, in cooperation with medical and commercial facilities as well as health promotion facilities indispensable for daily life in the community.</p> <p>🔗 Topic: Launch of Japan’s first demonstration experiment on “AI-operated bus” linked to the local service system in Yokosuka City</p>
IoT	Future Home Project	<ul style="list-style-type: none"> Yokohama City and factory, inc. 	<p>Proceeding with the Future Home Project to provide insight by visualizing the living conditions of residents and to consider and promote the creation of a comfortable indoor environment.</p> <p>🔗 Yokohama City launches the Future Home Project with and factory, Inc. using IoT smart homes (press release material)</p>
	docomo Smart Parking System	<ul style="list-style-type: none"> Prestige International Group 	<p>Provide IoT/ICT-driven solutions so that parking lot operators can use narrow spaces in parking lots, thereby addressing the severe lack of parking spaces in urban areas (a commercial service is now available in Tokyo and Osaka).</p> <p>🔗 Launch of the “docomo Smart Parking System” as a solution for parking lot operators (press release material)</p>

*1 Enhanced mobile broadband

*2 Ultra-reliable and low-latency communications

Co-creation with Ventures

Considering future social environments and industry trends, DOCOMO is supporting the growth of venture companies and promoting co-creation with them through investments via DOCOMO Ventures, Inc., a DOCOMO subsidiary, and incubation activities.

As for investment activities, we focus on the business domains stated in our “Declaration beyond” Medium-Term Strategy 2020 and are making strategic investments in anticipation of generating synergies with our business.

In terms of incubation activities, for the purpose of strengthening contact points with an entrepreneur, we have provided a coworking space and a close-following support such as incubation program, which 12 seed-stage startups have planned to move in. Moreover, we hold regular business seminars for startups and match our businesses with those of ventures, promote exchanges between our employees and entrepreneurs, and support young entrepreneurs.

In one of these developments, DOCOMO is expanding the live viewing experience.

The entertainment business requires the development of an optimal system by integrating various aspects, such as content and devices. Therefore, it is vitally dependent on co-creating with business partners. We hope to forge a partnership that enables us to effectively disseminate venture assets through our infrastructure.

Representing one of our achievements is a collaboration with a venture company that provides the video extension technology TIG, which allows users to stock up objects they want to know about or go to a detailed page by just touching the part of the video in which they are interested. With regard to New Experience Live CONNECT™, we expanded our service to create new entertainment experiences that integrate

new video technologies in the 5G era, such as enjoying access to information on artists and music, without having to search the browser and simply by touching the promotional video. By doing so, they can also enjoy new content that allows them to access detailed information by merely touching a photo or text in a digital photobook created by a live performer.

IoT×5G×SDGs Partner Co-Creation Project

DOCOMO will contribute to achieving the Sustainable Development Goals (SDGs) adopted by the United Nations in 2015 by focusing on the “connecting” technologies of IoT and 5G. We are integrating the strengths of multiple partners in their respective areas of expertise to create solutions for social issues included in the SDGs while also seeking to develop new, sustainable businesses.

As part of these initiatives, we launched the IoT×5G×SDGs Partner Co-Creation Project in December 2018 to explore new business possibilities. We partner with companies and organizations participating in the “DOCOMO 5G Open Partner Program” that are willing to collaborate with us in co-creating solutions, particularly in the area of IoT, to achieve the SDGs.

Specifically, we set up working groups with our partners, with each group seeking to create new businesses for achieving each SDG. We also organize joint workshops to share information among the groups. The working groups are managed by DOCOMO and a co-leader who will play a central role in each project. We have established an effective scheme for co-creation through the participation of many companies. We support our corporate partners through measures such as providing verification environments and advanced use of communication devices, expanding sales through our corporate channels, publishing information on its corporate

website, and jointly exhibiting at trade shows.

Moreover, we are taking action by setting up three working groups addressing three themes selected from key social issues: rising medical costs and burden of nursing care; the labor shortage and handing down of technology in the manufacturing industry; and ensuring safety and security amid an increase in nuclear families and dual-income families.

Going forward we will strengthen our collaboration with partners across a wide range of industries and accelerate our efforts to create new IoT solutions in the 5G era while achieving the SDGs.

Opening up “docomo AI Agent API”

DOCOMO has been providing the interactive AI service “docomo AI Agent API” for corporate customers since April 2019, which is also used for DOCOMO’s “my daiz.” Creating a scenario for each purpose enables contextual Q&A services and a natural dialogue with the user. In addition, the interactive original agent created through this service incorporates voice recognition, natural language processing, and voice synthesis while allowing for voice dialogue with the user. The AI Agent’s voice can be chosen from more than 50 options.

DOCOMO has made this API openly available and is promoting the docomo AI Agent Open Partner Initiative, in which it jointly develops a new service based on a speech interface.

By opening up the use of services cultivated by DOCOMO and the API for device providers, we intend to create speech and text-based services that provide new experiences for end users, forge win-win business relationships with partners, and reduce the development period for AI-agent services.

Collaborations with partners in diverse areas allow us to

create applied products based on the specialized standpoints of these areas that would not have been possible for DOCOMO to accomplish alone. For example, the robot service for watching the elderly is a product specialized for the domain, including its purpose, which was only possible through collaboration. We also worked with a local government to introduce a chatbot using AI conversation technology that provides guidance on sorting garbage. This resulted in raising the efficiency of responses to queries on garbage sorting, and we learned from a verification trial conducted with Yokohama City that 30% of the queries were from citizens accessing the service outside of business hours.

We will realize AI agents to familiarize users with the diverse services offered by partners through natural communication supported by AI to deliver benefits, satisfaction, and security for every customer.

Commercial Launch of “docomo Open Innovation Cloud™”

In March 2020, we launched “docomo Open Innovation Cloud™ (dOIC),” a service using cloud computing facilities (hereinafter, cloud infrastructure) connected to DOCOMO's network that realizes low latency.

It is a cloud service that features MEC*1 (multi-access edge computing) such as the low latency and high security required for the 5G era. It is realized by building a cloud infrastructure in the equipment of DOCOMO's communication network.

Previously provided as a “docomo cloud infrastructure,” it has been sequentially equipped with technologies such as the image recognition API*2 developed by DOCOMO, video transmission by DOCOMO and its partners, and 11 solutions

such as VR and AR.

As of the end of October 2020, it is in operation at four bases: Tokyo, Osaka, Kanagawa, and Oita. Going forward we will gradually expand the solutions installed in the cloud infrastructure to contribute to the creation of new value and resolution of social issues through 5G so that our customers can lead more convenient and enriched lives.

*1A mechanism for deploying servers and storage closer to customers in the mobile communication network.

*2 Part of the image recognition technology constitutes AI “corevo®” of the NTT Group.

Mirai Translator

Going forward, machine translation technology is expected to develop, more tourists will visit Japan, and a larger number of Japanese companies will expand their business overseas. Given these trends, we established Mirai Translate, Inc. in October 2014. We are currently providing machine translation solutions by leveraging the large volume of translation corpus, ongoing tuning by professional engineers, and our mobile terminal development capabilities and sales network, in which NTT DOCOMO, NTT Communications Corporation, Panasonic Corporation, and Honyaku Center Inc. all maintain strengths.

In December 2017, we launched the Mirai Translator™ as a cloud machine translation service that can be accessed on the Internet using a web browser. It is equipped with a neural machine translation (NMT) engine with a proficiency in writing English equivalent to levels higher than a TOEIC score of 960 (as of April 2019) in Japanese-English translation. We also sell the translation engine to NTT Group companies and affiliates. Through sales of Mirai Translator, our machine translation engine, and speech translation solutions, as well as the

provision of machine translation platform services and their related consulting services, we expect to achieve 1 billion yen in operating revenues in fiscal 2020.

Mirai Translator, a web browser-based cloud machine translation service translates text data as well as Microsoft Office format files (PowerPoint, Word, Excel), or PDF format, while keeping the layout unchanged, by a simple drag-and-drop operation. To realize stress-free communication between different languages in various business settings, including daily conversations and documents with many technical terms, such as agreements and internal documents, we are promoting our machine translation platform service, which is safe and scalable and can be customized for the business domains of our customers. With this service, we are helping to globalize Japan.

DOCOMO R&D Open House

We hold a DOCOMO Open House every year to showcase the company and the NTT Group's latest R&D efforts and promote our +d initiatives. In fiscal 2019, it was held under the title of DOCOMO Open House 2020 and included lectures by DOCOMO's partners in co-creation as well as 273 exhibits of the latest technologies such as 5G, AI, and IoT. We also introduced various service solutions using 5G, for which commercial service began in the spring of 2020. Additionally, we indicated the specific SDGs linked to all the services we presented there, to convey how our services are contributing to the achievement of the SDGs.

Date: January 23–24, 2020

Venue: Tokyo Big Sight Aomi Exhibition Hall

Visitors: 23,585 (previous fiscal year: 14,176, an approximately 70% increase)

This event represents an important opportunity to strengthen our collaboration with various partners because of its broad appeal to stakeholders who have some relation to our efforts to improve added value for customers and the creation of social value through our mid- to long-term R&D initiatives.

Promoting Process Innovation (Top Gun)

In October 2017, DOCOMO began its Top Gun initiative, in which the R&D and Corporate Sales and Marketing departments formed an elite team and work as one with customers to address challenges. This involves a swift process that encompasses identifying issues and needs, creating solutions, developing business projects and monetizing them. We also established a maintenance and operation system for our solutions created through the Top Gun initiative, which are sold nationwide as a packaged product for corporate customers.

Top Gun collaborations between R&D and Corporate Sales and Marketing are not limited to the departments at the head office. Corporate Sales and Marketing staff at DOCOMO's regional offices and branches in Japan can voluntarily join the initiative to solve issues faced by local companies and governments, and the number of participants is rising. We set up a system for sharing information about Top Gun nationwide so that the head office can closely cooperate with the regional offices and branches, and at the head office we provide space where staff working at that location can meet for discussions with colleagues from regional offices and branches. These efforts encouraged greater interaction and collaboration between the R&D departments and corporate sales departments at our regional offices and branches nationwide. We will create solutions at a much faster pace by having R&D members responsible for developing the technology visit customers to make on-the-spot decisions as to whether or not it will be useful for resolving a particular issue and to present even better solutions.

Having R&D staff responsible for developing the technology visit customers together with Corporate Sales and Marketing staff allows for the connecting of needs with potential

solutions. We can also verify and resolve issues simultaneously and with speed, and to turn technological possibilities into value for customers while making full use of the cutting-edge technologies we provide them with solutions. We will pursue this initiative to accelerate the pace of "+d" co-creation toward achieving Declaration 4: Industry creation and Declaration 5: Solution co-creation under our "Declaration beyond" Medium-Term Strategy to 2020. As of July 2020, we had engaged in 29 projects, of which 14 have been commercialized and 7 are ongoing. We intend to further accelerate the pace of our Top Gun initiative.



Awards for Innovation

NTT DOCOMO received the following awards for innovation in fiscal 2019 and 2020.

Host	Award		Award-winning Project and Rationale (Affiliation as of Winning Award)	Date
Institute of Electronic, Information and Communication Engineers (IEICE)	Achievement Award		Commercialization of 5G mobile communication system <ul style="list-style-type: none"> Takehiro Nakamura (5G Laboratories) Yukihiko Okumura (5G Laboratories) Tetsuro Imai (formerly 5G Laboratories, currently Tokyo Denki University) <p>Recognized for the early start of studying new technologies and methods since 2010 toward commercializing 5G, which has features such as high speed, large capacity, low latency, and connection to multiple terminals, and for promoting commercialization through a wide range of efforts, from research and development to service application, for nine years.</p>	June 4, 2020
	Yasuharu Suematsu Award		Standardization of radio access network architecture and radio interface protocols for mobile communication systems <ul style="list-style-type: none"> Anil Umesh (Radio Access Network Development Department) <p>Recognized for contributions to establishing standard specifications, mainly in the 3rd Generation Partnership Project (3GPP), for 3.5th (HSPA), 4th (LTE and LTE-A), and 5th (5G) generations, as well as contributions to the O-RAN Alliance that enables the use of a common interface between the parent device in the 5G base station and wireless devices in the latest advances towards 5G standardization.</p>	June 6, 2019
			Standardization of a wireless interface physical layer design for 4th and 5th generation mobile communication systems <ul style="list-style-type: none"> Hiroki Harada (5G Laboratories) <p>Recognized for his substantial contribution to the 4G that became an indispensable social infrastructure and the 5G that will greatly benefit industries going forward, by formulating the standard specifications for the physical layer designs for 4G and 5G wireless interfaces in 3GPP.</p>	June 4, 2020
Ministry of Education, Culture, Sports, Science and Technology	The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology	Prize for Science and Technology (Development Category)	Development of advanced C-RAN and FDD-TDD-CA <ul style="list-style-type: none"> Sadayuki Abeta (Radio Access Network Development Department) Toshiro Kawahara (formerly Radio Access Network Development Department, currently DKK Co., Ltd.) Hiroyuki Atarashi (Radio Access Network Development Department) Yoshitsugu Shimazu (Radio Access Network Development Department) <p>Recognized for their substantial contributions to the acceleration of 4G by developing advanced C-RAN and FDD-TDD-CA, technologies for carrier aggregation through the combination of small and macro cells.</p>	April 7, 2020
		Prize for Science and Technology (Science and Technology Promotion Category)	Promotion of population flow statistics generated from mobile phone base station data <ul style="list-style-type: none"> Daizo Ikeda (Research Laboratories)* <p>Recognized for the use of population flow statistics, based on the operation data of mobile phone networks, in a wide range of fields such as town development, transportation and disaster prevention plans, regional revitalization, and marketing as the largest transportation big data in Japan.</p>	
Tsushinbunka Association	Hisoka Maejima Award		Commercialization of network virtualization technology capable of running the EPC software of multiple vendors <ul style="list-style-type: none"> Hiroyuki Oto (Radio Access Network Development Department) Yasuyuki Uchiyama (Radio Access Network Development Department) Kazuaki Obana (NTT Network Innovation Laboratories) <p>Recognized for their extraordinary contribution to the mobile communication industry through this commercialization, the world's leading example in network virtualization, and for their distinguished achievement.</p>	April 10, 2019
			Formulation of international standard specifications for the commercialization of 5th generation mobile communication systems <ul style="list-style-type: none"> Satoshi Nagata (5G Laboratories) <p>Recognized for taking the significant lead in formulating international standards for 5G, including specifications for high-speed large-capacity transmission, by actively participating in 3GPP standardization conferences and serving as the chairperson and vice-chairperson of the 3GPP TSG-RAN Working Group.</p>	March 4, 2020

*Jointly with related parties, including the Ministry of Land, Infrastructure, Transport and Tourism

Host	Award		Award-winning Project and Rationale (Affiliation as of Winning Award)	Date
ITU Association of Japan	Celebration of World Telecommunication and Information Society Day	ITU-AJ Accomplishment Award	· Toshiro Kawahara (Radio Access Network Development Department) Recognized for contributions to expanding the scope of multimedia communication protocols for mobile communication in the ITU-T, standardizing an error-resilient video and audio communication system in MPEG-4, and standardizing and commercializing LTE in 3GPP as well as efforts made in the founding of O-RAN, a standardization body for mobile communication protocols.	May 17, 2019
			· Hiroshi Aono (Service Innovation Department) Recognized for his long-term contributions to the standardization of mobile networks in the 3GPP to improve security and address the latest trends in security standardization activities in order to bolster the telecommunications industry in Japan through participation in the Association of Radio Industries and Businesses (ARIB).	October 6, 2020
		ITU-AJ Encouragement Award	· Yuya Kuno (Core Network Development Department) Recognized for contributions to promoting discussions on interface specifications in a multi-vendor configuration of a network function virtualization system from the standpoint of actual operation, for the early finalization of interface specifications, and for promoting discussions on testing specifications for interoperability.	May 17, 2019
			· Kazuki Takeda (5G Laboratories) Recognized for taking the lead in specifying the physical-layer control channel that forms the basis of the 5G system, contributing significantly to standardizing 5G based on commercial requirements, and compiling component technologies underlying the 5G physical layer as an editor of 5G technical specifications.	
	· Masahide Murakami (Core Network Development Department) Recognized for taking the lead in revising the documentation for the VoLTE roaming system and drafting the documentation of IP interconnection in GSMA.			
	· Hiroshi Ishikawa (Core Network Development Department) Recognized for significant contributions to ETSI TISPAN by enabling the use of IMS for purposes other than mobile access, and to 3GPP by introducing DSAC, enhancing IMS, and specifying the 5G protocol. He has also contributed to GSMA to the profile specification for 5G roaming.		October 6, 2020	
	· Yoshihiro Nakajima (Core Network Development Department) Recognized for leading the discussions among equipment vendors and telecom operators in building consensus on NFV's future as well as promoting standardization. He has also contributed to improving the MANO function group interface specifications and quality of the test specifications (based on development feedback)			
	· Suguru Okuyama (R&D Strategy Department) Recognized for contributions to the formulation of various wireless specifications related to base station equipment in an LTE-Advanced upgrade and NR standardization in 3GPP. Also recognized for contributions to the formulation of standard specifications that enable multi-vendor connections in the xRAN Forum and O-RAN Alliance.			
· Teruaki Toeda (Radio Access Network Development Department) Recognized for contributions, as a rapporteur on 5G NR work items in 3GPP, to formulating standard specifications for wireless network architecture suitable for base station equipment configurations in the 5G era as well as formulating standard specifications that enable multi-vendor connections.				
Global Corporate Venturing	GCV Power list Award 2020		· Takayuki Inagawa (NTT DOCOMO Ventures, Inc.) This award is given by Global Corporate Venturing , a global media company related to corporate venture capital (CVC), to the top 100 CVC investors out of more than 2,000 companies worldwide once a year. As activities of NTT DOCOMO Ventures and its representative so far, the number of investments, the degree of growth of investees, the status of business alliances with the investees, and the strategic ability and leadership at public and other meetings were all comprehensively evaluated.	September 16, 2020

Host	Award		Award-winning Project and Rationale (Affiliation as of Winning Award)	Date
Association of Radio Industries and Businesses (ARIB)	The Meritorious Award on Radio	The Award of the Minister of Internal Affairs and Communications	Formulation of international standard specifications for the commercialization of 5th generation mobile communication systems <ul style="list-style-type: none"> Satoshi Nagata (5G Laboratories) Recognized for taking the significant lead in formulating international standards for 5G, including specifications for high-speed, large-capacity transmission, by actively participating in 3GPP standardization conferences and serving as the chairperson and vice-chairperson of the 3GPP TSG-RAN Working Group.	June 25, 2019
		The Award of the Chairman of the Board of ARIB	Open development of wireless access network specifications <ul style="list-style-type: none"> Open Wireless Access Network Promotion Team leader Sadayuki Abeta (Radio Access Network Development Department) Recognized for contributing to the establishment of the O-RAN Alliance with four overseas carriers in February 2018 to realize an open, flexible, and intelligent wireless access network (RAN) and sharing the specifications in March 2019, which led to the adoption of its specifications by major global operators and vendors.	
		The Award of the Minister of Internal Affairs and Communications	Development and practical application of a 5th generation mobile communication system <ul style="list-style-type: none"> Kazuhiro Yoshizawa^{*1} Recognized for his significant contribution to the effective use of radio waves by realizing 5G service. In order to develop and commercialize 5G systems, he worked on the feasibility verification and evaluation of 5G-related technologies from an early stage, conducted demonstration experiments with partners to solve social issues and used them for regional revitalization, and promoted international standardization activities.	June 24, 2020
		The Award of the Chairman of the Board of ARIB	Promotion of frequency sharing due to 700 MHz termination promotion measures <ul style="list-style-type: none"> Makoto Kono (Hokkaido Branch, Network Department)^{*2} Recognized for contributing to the effective use of radio waves through termination promotion measures by launching the service in sequence after building base stations while shifting radio stations sequentially. In order to secure the frequency of the 3.9G mobile communication system, the frequency of the 700 MHz band was changed; shifting all frequencies of wireless systems (specific radio microphones) was completed by the end of 2018. Development of a glass antenna for communication that does not spoil the appearance of buildings or cars <ul style="list-style-type: none"> Takehiro Nakamura (5G Laboratories)^{*3} Recognized for his substantial contribution to the effective use of radio waves by expanding the service area through the conversion of windows into base stations using glass antennas and developing 5G glass antennas for vehicles in the 28 GHz band.	
Telecommunication Technology Committee	Telecommunication Technology Award	TTC Chairperson's Award	Achievements related to standardizing and promoting demonstration of network virtualization architecture in mobile communication networks <ul style="list-style-type: none"> Motoi Tamura (Network Department) Recognized for taking the lead in establishing standards in and outside of Japan for mobile communication networks, including ALL-IP, CS-IP, IMS service (RCS and others), and network virtualization/Openflow.	June 18, 2019
			Achievements related to the sophistication of operating systems and standardization of core network virtualization in mobile communication systems <ul style="list-style-type: none"> Kozo Sakae (R&D Strategy Department) Recognized for his great contribution to the creation and dissemination of standards in the sophistication of operating systems and the standardization of core network virtualization.	May 28, 2020
Information Processing Society of Japan	IPSJ Industrial Achievement Award		Development and practical application of so-called "real-time demographics," which contribute to addressing social concerns such as disaster prevention and traffic congestion <ul style="list-style-type: none"> Masayuki Terada (Research Laboratories) Hiroto Akatsuka (Research Laboratories) Yusuke Fukazawa (Service Innovation Department) Shin Ishiguro (Service Innovation Department) Recognized for showing the possibility of real-time demographics that can become a new data infrastructure for solving various social issues. Real-time demographics estimate changes in the population distribution throughout Japan from mobile phone network operation data, and their usefulness has been confirmed across a wide range of industries such as AI congestion prediction and AI taxi.	June 3, 2020

^{*1} Jointly with KDDI and Softbank

^{*2} Jointly with Association of 700 MHz Frequency Promotion, KDDI, and Softbank

^{*3} Jointly with AGC