

Innovation to realize a society with a sustainable future

Tackling social issues head on, we will apply new technologies to deliver innovations that blaze a path to the future.

Broader base of core technologies to realize a society with a sustainable future

A host of contemporary social issues, such as overpopulation, the depletion of energy and natural resources, and the effects of climate change, are impacting our world. In addition, people can now engage in intellectual production activities through IT networks, a trend that has heightened the need to revisit workstyles from more perspectives than ever before. Furthermore, the advent of the IoT (Internet of Things) society is upon us, and companies are increasingly utilizing Big Data to dramatically boost productivity.

Given the changes taking place in society, the Ricoh Group has embraced the opportunity to be a trailblazer in innovation, combining core technologies related to optics, chemicals, networks, software and image processing with new ideas and technologies—thereby helping to realize a society with a sustainable future. ➤ [WEB 1](#)

New value transforms workstyles and lifestyles

Since pioneering the office automation business in the 1950s, the Ricoh Group has been a catalyst in creating workstyles with an ever-higher value quality. Our definition of “office” encompasses the way people work, the processes that characterize their businesses, and the work environment—which evolve along with changes in society—and we strive to develop technologies that revolutionize customer workstyles through various new products and solutions that smooth communication anytime, anywhere.

Also, by integrating unique optics and image processing technologies, we turned the fully spherical RICOH THETA—an unprecedented

achievement in camera development that captures images all around the photographer in a single shot—into a business, and ushered customers into a new world of images documenting life. ➤ [p. 33](#)

Creating value in new domains

Ricoh is directing concerted efforts into the industrial market, which has been tapped as a business domain where Groupwide strengths in technology accumulated over many years in manufacturing that begins from the product idea stage can be fully utilized. We are making progress in the priority areas of factory automation (FA), automotive applications, and security systems. We recently launched consulting services, targeting manufacturing customers, for 3D printer installation, based on prototyping and molding technologies and accumulated know-how using 3D printers in our own product design over the past 20 years. We have also marked success in the field of energy harvesting,* with development of technology applicable to IoT-connected tools and the inherent infrastructure of the IoT society. ➤ [p. 27–29, 34](#)

R&D fueling innovation

The Ricoh Group has R&D sites in Japan, the United States, India and China. Each site explores market needs and conducts research and technology development attuned to regional characteristics while deepening cooperative connections among global sites. Our corporate map also includes technology centers and printing innovation centers, and we launch value-creating activities involving our customers through a framework for gathering feedback on market needs ascertained directly through customer support activities to enhance future product development. ➤ [p. 36](#)

* Energy harvesting:
Converting energy from sources in the environment, such as light, pressure, vibration, heat and radiowaves, into power

Ricoh's technology development process for core businesses is broken down into three stages—research and technology development, product development, and sales and support. We emphasize system solutions development and customized development to fuel more robust responses, from the development of key technologies based on technology strategy through efficient product development without relying on prototypes, and then to customer needs. ► WEB 2, 3

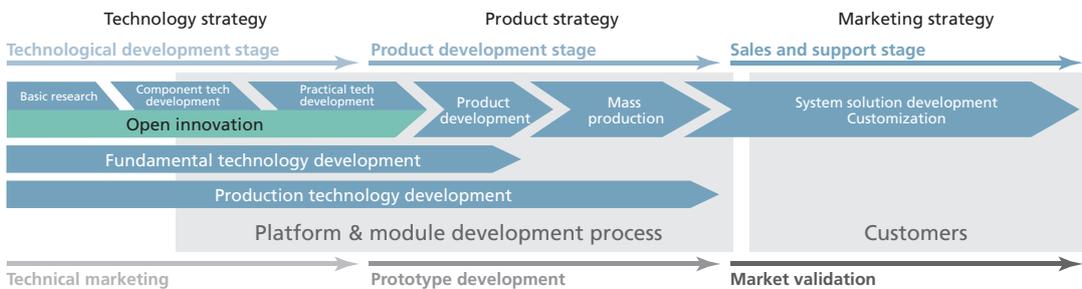
Open innovation

We subscribe to the idea of open innovation, actively drawing on the capabilities of universities, research institutes and companies, to effectively promote development of cutting-edge technology. Looking to apply core technologies, such as inkjet and laser printing technologies, we actively participate in Japan's Funding Program for World-Leading Innovative R&D on Science and Technology and in joint R&D activities with universities and incorporated administrative agencies.

Examples of open innovation:

- Use of inkjet technology in research to regenerate myocardial tissue with new muscle cells derived from induced pluripotent stem cells
- Application of electro-photographic laser printing technology (VCSEL) to a cogeneration ignition system
- Use of electrochromic technology in the development of full-color e-paper based on printed electronics

• Development process for core businesses



Investing in R&D and initiatives in intellectual property

The Ricoh Group consistently earmarks about 5% to 6% of consolidated sales for R&D to ensure a steady stream of innovation. In fiscal 2015, R&D expenses reached ¥118.7 billion, about 5.3% of sales. Of this amount, 12.5%—¥14.9 billion—went into basic research.

Intellectual property—the fruit of our R&D efforts—is one of the most precious resources we have for securing a competitive advantage in the market. Therefore, we encourage efforts that yield valuable intellectual property and seek to acquire

and utilize intellectual property that protects and grows our businesses.

In fiscal 2015, we published 4,989 patents in Japan and, as of March 31, 2015, we retain rights to more than 25,000 patents in Japan and more than 22,000 patents overseas. Our commitment to innovation is further substantiated by the high regard of third-party organizations.

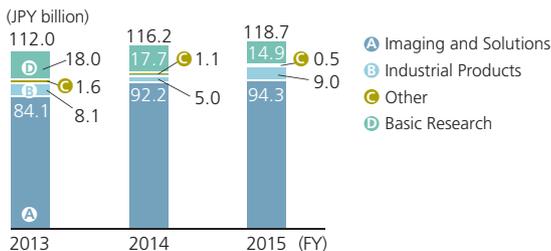
Going forward, we will continue to actively promote patent acquisition at home and abroad, paralleling expansion into new business territory and globalization, mainly in emerging markets.

► WEB 4

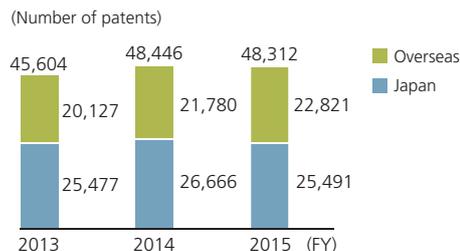
Third-party evaluation: Top 100 Global Innovators

In November 2014, Ricoh was named to Thomson Reuters 2014 Top 100 Global Innovators list, which recognizes the world's most innovative companies and organizations. This award honors companies that lead global business by protecting the creative ideas of inventions through intellectual property rights and transforming them into successful forms of business. ► WEB 5

• Changes in R&D investment



• Number of patents registered in Japan and overseas



► WEB 2 Global R&D: www.ricoh.com/technology/rd/global.html
 ► WEB 3 Development process innovation: www.ricoh.com/technology/rd/manufacture.html
 ► WEB 4 Initiatives in intellectual property: www.ricoh.com/technology/rd/ip.html
 ► WEB 5 Thomson Reuters 2014 Top 100 Global Innovators list: thomsonreuters.com/en/press-releases/2014/thomson-reuters-names-the-2014-top-100-global-innovators.html

Providing value—Developing technology that anticipates changes in the office

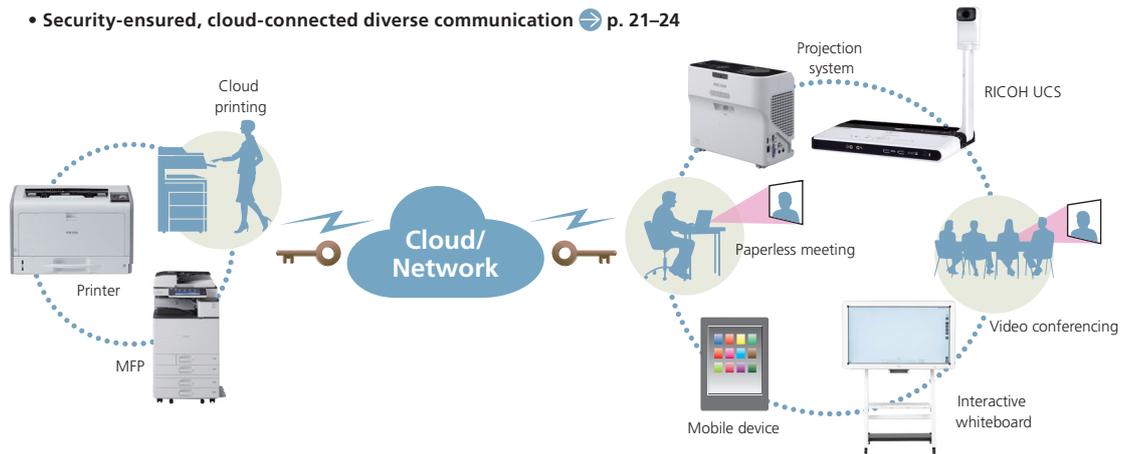
Into an era of workstyles where people connect anytime, anywhere

The cloud environment for networked equipment is becoming more complete, facilitating various workflows even in the imaging equipment domain. By interfacing MFPs with cloud services and strengthening security features, Ricoh provides an environment for flexible printer and scanner use in-house as well as an environment for safe document access from outside. In addition, communication becomes a smooth and easy-to-implement process with the interactive whiteboard, which

enables remote locations at home and abroad to share images and information in real time, and the RICOH Unified Communication System (RICOH UCS), a portable teleconferencing system.

In this way, the Ricoh Group leverages innovative technology to build workflow structures connecting customers' in-house and outside activities and to support workstyles anytime, anywhere. We seek to ensure secure but nonetheless convenient and easy connections and will make inroads with safer, more comfortable and more convenient access whether the underlying workstyle is old or new. > WEB 1, 2

• Security-ensured, cloud-connected diverse communication > p. 21-24



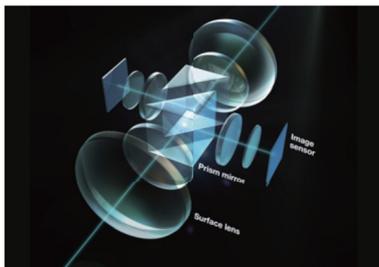
Creating a new world of images



RICOH THETA

Fully spherical RICOH THETA expands the realm of value

The RICOH THETA overturned the conventional concept of a camera, incorporating all the space surrounding the photographer in a single shot. This was achieved with two superwide-angle lenses (fish-eye lenses) and the fusion of Ricoh's proprietary optics and image-processing technologies, which stitch together omnidirectional images with no blind spots. In 2014, we launched the RICOH THETA m15, in response to high user demand for the ability to shoot 360° videos.



Symmetrically positioned inflection optical systems

The video capability of this spherical camera has the potential to provide greater value. For example, with the addition of a GPS (global positioning system) function and network or cloud connectivity, the RICOH THETA m15 could have applications in crime prevention and monitoring systems in the security and medical and nursing care fields. This product has tremendous potential for extending new value and will contribute to a society that offers a sustainable future. > WEB 3

> WEB 1 Interactive whiteboard: www.ricoh-europe.com/products/interactive_whiteboard/

> WEB 2 RICOH UCS: www.ricoh.com/ucs/

> WEB 3 RICOH THETA: www.ricoh.com/technology/tech/065_theta.html

Providing new value to industrial market

Machine vision contributes to the enhancement of social infrastructures

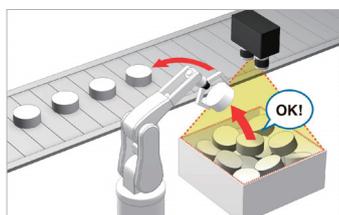
We have promoted in-house development of automated production facilities since the late 1970s, and through such approaches as the installation of sensor modules at the inspection stage, we have refined machine vision technology, which tracks and assesses situations without human involvement. Machine

vision not only offers performance incredibly close to that of human sight, it also has the capacity to instantaneously identify two- and three-dimensional information as well as information beyond the range of the human eye. Consequently, machine vision facilitates automation in areas where manufacturers have always had to rely on human workers, and it will become steadily more indispensable to the social infrastructures of tomorrow. ► [WEB 4](#)

FA stereo camera

Realizing fast, highly accurate 3D measurement of objects, this camera facilitates the automation of diverse systems, including work done by pick-and-place robots and the monitoring and control of a device environment, and contributes to higher operating efficiency in production line work and at many other sites, including those in the logistics sector. ► [WEB 5](#)

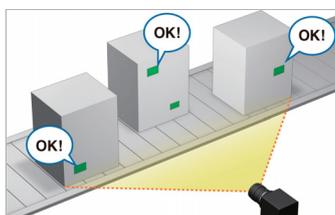
Accurate object capture possible because robot can acquire correct position



Extended depth-of-field camera

This camera captures multiple objects at different depths without adjusting for distance or angle between object and camera. Installation of this camera above a production line at an inspection point, for example, which has to date required multiple cameras or visual confirmation, will lead to reduced costs and higher productivity. ► [WEB 6](#)

Wide depth-of-field facilitates recognition in foreground and background



2D color analyzer

Able to execute real-time measurement of color data difficult to perceive with the naked eye, this surface measurement-type camera has a wide shooting range to acquire detailed color data in a single shot. It improves efficiency in such processes as checking for irregularities or differences in color on large displays and repositioning digital signage. ► [WEB 7](#)

High-precision display measurement in a single shot



Developing technology in environmental field

Stand-alone power source technology increasingly needed for IoT society

In the IoT society of the near future, all sorts of things will have sensors, heightening the need for stand-alone power source technology to enable communication even in places where power may be hard to come by. Consequently, interest has been piqued by the prospect of technology to generate power from the environment—energy harvesting—which draws a tiny amount of energy within the local environment, such as sunlight and illumination or vibration and heat, and converts it to power to run devices.

Ricoh actively pursues new technology development as a key to unlocking the future of energy harvesting.

Solid-state dye-sensitized solar cell suitable for indoor lighting

Ricoh successfully developed a complete solid-state dye-sensitized solar cell that can effectively generate power even under a weak light source, such as LED lighting. Based on organic photoconductor technology accumulated in the development of imaging equipment, the solar cell consists only of easy-to-handle solid-state material and boasts more than twice the electric output of existing amorphous silicon solar cells. Practical use of the technology has already begun, with application to terminals that constantly monitor indoor temperature and humidity levels and light intensity. ► [WEB 8](#)



Dye-sensitized solar cell

Energy-generating rubber combines flexibility and high output

Piezoelectric materials, notably, ceramics and polymers, create energy through the application of pressure, but their widespread use has been hindered either by a limited range of applications or problems with output performance. Ricoh successfully developed a new material—an energy-generating rubber—that demonstrates polymer's advantage of flexibility and output as high as that of ceramics through pressure and vibration. Efforts are moving forward on various applications, including sensors. ► [WEB 9](#)



Energy-generating rubber

- [WEB 4](#) Machine vision (white paper): www.ricoh.com/technology/whitepaper/pdf/wp_mv.pdf
- [WEB 5](#) Stereo camera: www.ricoh.com/technology/tech/045_stereocamera.html
- [WEB 6](#) Extended depth-of-field camera: www.ricoh.com/technology/tech/050_edof.html
- [WEB 7](#) 2D color analyzer for display inspection: industry.ricoh.com/en/fa_camera_lens/2d-color-analyzer/cv-10a/
- [WEB 8](#) Complete solid-state dye-sensitized solar cell: www.ricoh.com/technology/tech/066_dssc.html
- [WEB 9](#) "Energy-Generating Rubber" Combines Flexibility and High-Output: www.ricoh.com/release/2015/0518_1.html