Continuing to provide new value to society through our core technology and unique ideas

We will create products and technologies that help transform customer workplaces and resolve social issues.

Providing new value for diverse workplaces

We have brought out ideas for innovative work styles since entering the business machine field in the 1950s. We are now broadening the scope of the value we create from regular offices to worksites in various industries and locations. By digitizing work in various places, we are helping customers work smarter. By providing new value to individuals, organizations and society, we can resolve social issues while generating new growth opportunities.

We are helping to change workplaces and society and continue providing value to customers through the core technologies that we have innovated in many years of product development. They include the image processing, optics, materials and devices, environment, networking, and software fields. We will bring these technologies together with new ideas and other technologies to pursue even more innovations.

Seeking to create value in new areas

One new R&D fields for us is to create knowledge so people can work smarter. We also aim to build value through inkjet technologies that broaden the potential of printing.

We help customers to create knowledge by innovating for a range of workplaces. We do this through the use of machine vision and other input, artificial intelligence analysis, and through optimal combinations of displays, controls, and other processes. Inkjet technology applications have expanded to encompass commercial printing, industrial printing, and healthcare. We are going beyond printing on paper to push ahead with inkjet printhead applications for functional printing on other media, notably for bioprinting and electronic circuit printing.

R&D structure and development process

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.

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.

Refer to our website

1 Technology www.ricoh.com/technology/
1 Global R&D www.ricoh.com/technology/rd/global.html
3 Technology Development www.ricoh.com/technology/rd/development.html
4 Development process innovation www.ricoh.com/technology/rd/manufacture.html
Engaging in open innovation

We are drawing on open innovation with universities, research institutions, and enterprises to accelerate efforts to help resolve social issues, streamlining the development of advanced technologies.

We are applying our inkjet, machine vision, image processing, and other technologies in diverse initiatives. They include the Japanese government-supported Funding Program for World-Leading Innovative R&D on Science and Technology and joint R&D with universities and independent administrative corporations. We are reinforcing relationships with venture enterprises to accelerate the creation of new businesses.

Open innovation case study

Inspecting bridges with drones P.39
We are undertaking research under the auspices of the Infrastructure, Maintenance, Renovation and Management Technologies initiative of the Cross-Ministerial Strategic Innovation Promotion Program of the Japanese Cabinet’s Council for Science, Technology and Innovation. The New Energy and Industrial Technology Development Organization is supervising that initiative. The theme is R&D into drone systems for acoustic and proximity visual inspections of bridges. Associate Professor Kazunori Ohno of Tohoku University is heading this research.

3D bioprinters P.40
We are participating in a national project led by the Japan Agency for Medical Research and Development, which is undertaking joint research with Osaka University.

Inspecting roads with stereo cameras P.39
We developed technologies as part of the Road Surface Condition Monitoring Verification Testing Consortium. Its members are the Ministry of Land, Infrastructure and Transport, Akita Prefecture and Semboku, a city in that prefecture, and the Ricoh Institute of Information and Communication Technology.

In March 2016, we established a fund to foster tech ventures that drive progress in next-generation industries.

Through this fund, we aim to contribute to industry development by financing tech ventures and by supporting start-up and accelerating the commercialization of technologies.

R&D investments and intellectual property initiatives

The Ricoh Group consistently earmarks 5% to 6% of consolidated sales for R&D to ensure a steady stream of innovation. In the fiscal year ended March 31, 2017, R&D expenses reached ¥114.3 billion, or about 5.6% of sales. Of this amount, 10.7%, or ¥12.3 billion, went into basic research.

Intellectual property, the fruit of our R&D efforts, is vital to our competitiveness. We therefore encourage efforts that yield valuable intellectual property and seek to acquire and use intellectual property that protects and grows our businesses. We have deployed business and technological strategies to reinforcing core businesses, globalizing by cultivating operations in emerging nations, and launching new businesses to expand our domains.

We have deployed strategies to expand our domains, reinforcing core businesses, globalizing by cultivating operations in emerging nations, and launching new businesses. We accordingly continue to secure patents in Japan and abroad. As a result, the number of registered patents overseas has exceeded the number in Japan since the fiscal year ended March 31, 2015. We are conducting a review of maintained patent rights by assessing future market and business conditions and determining whether to abandon any unnecessary patent rights.

Changes in R&D investment

Number of registered patents worldwide

* In the fiscal year ended March 31, 2017, R&D investments relating to the camera business were included in the Other segment after being part of Imaging and Solutions. If R&D investments based on the approach for the fiscal year ended March 31, 2016 were applied in the fiscal year ended March 31, 2017, they would have been ¥3.4 billion.
Transforming workplaces through knowledge creation

In pushing forward with EMPOWERING DIGITAL WORKPLACES, we are developing technologies to support ongoing knowledge creation by working people.

Supporting knowledge creation by organically linking inputting, processing, and outputting

We defined three necessary steps that we organically link and evaluate to supply smart systems and solutions that support knowledge creation.

- **Capture:** Collect a range of information with optimal devices
- **Analytics:** Examine and process collected information and convert it into intelligence
- **Visualize:** Optimally supply the results of processing to systems and people

### Road surface inspection system

Special vehicles are commonly used to maintain road infrastructure. We developed a camera system that can be mounted on standard monitor vehicles to evaluate road surfaces. Multiple stereo cameras can measure the rate of cracks, the depth of ruts, and flatness in a single pass. The system decodes images with a model obtained through machine learning, reducing man-hours. The Maintenance Control Index, a comprehensive benchmark for making repair decisions, is calculated based on findings, and provides support for writing up inspection records. The results can be mapped to visualize the road surface conditions.

### Public infrastructure inspection system

The aging of bridges and other structures has become a social problem worldwide. The need to perform inspections in high places poses considerable risks. Another issue in recent years has been shortages of inspectors.

We developed a spherical shell drone equipped with a camera that can maintain appropriate distances from target structures and can safely capture macro shots of bridge floor slabs and supporting sections. The photos are automatically reconstructed into 3D panoramic images. The system links images with bridge position information to help with preparing records according to inspection procedures. This saves a lot of labor and contributes to report consistency.

### Localization service

We provide services that optimize the use of precious time at medical institutions by pinpointing the locations of people and objects in real time, reducing inconvenience, wasted effort, and inconsistency.

Radio frequency identifier (RFID) tags on patients, medical staff, and medical equipment transmit information to in-hospital receivers. The acquired positioning data goes to our location information server on the cloud and is processed, with each location being displayed on in-hospital maps.

This setup eliminates considerable time otherwise wasted seeking people and objects, helping to streamline work efficiency.

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Refer to our website


Public infrastructure inspection system [www.ricoh.com/technology/institute/research/tech_inspection_system.html](http://www.ricoh.com/technology/institute/research/tech_inspection_system.html)
Expanding the potential of printing and creating new value

Ricoh has refined its inkjet technology over more than 40 years. The applications of technology launched for office printing have expanded to commercial and industrial printing, serving in such areas as clothing, food and housing.

Head technology for even and precise ink drops

Ricoh's inkjet technology comprises inkjet printheads that are pivotal for performance on various media, enabling the ink supplies to deliver the right image quality, and with color matching position control technology that precisely regulates positions. Our inkjet printheads eject ink from nozzles with piezo elements. Nozzles and housings are made of stainless steel to ensure high durability and long service lives. Our proprietary bi-pitch laminated piezo actuator ensures very precise and stable control of ejection volumes for various ink types.

Commercial printing system incorporating the latest technology

For the RICOH Pro VC 60000 high-speed continuous feed inkjet printing system, we deployed 1,200-dot-per-inch dual print head technology to deliver high-definition images for professional needs and Dynamic Print Head Positioning, our technology for improving dot position accuracy. This product employs an undercoating technology that keeps dot diameters stable and a protector coating technology that maintains the surface properties of paper materials. These technologies deliver high-quality printing on a wide range of paper, including offset coated stock.

Bio printers that position cells in 3D

It is necessary to precisely arrange different types of cells derived from induced pluripotent stem cells and assemble them three-dimensionally to reproduce biological tissue structures that closely approximate those of living bodies.

Ricoh is researching and developing 3D bioprinters that can mix cells with inks, disperse them in liquid, and stably eject cells from inkjet printheads without crushing them to produce artificial human tissues.

Pushing the boundaries of inkjet to open new world

We produced a website that overviews the expansion of our inkjet technology.

www.ricoh.com/technology/inkjet/

The site presents our technology, inkjet innovations, and development achievements over the years.

Refer to our website

- Industrial Inkjet: industry.ricoh.com/en/industrialinkjet/
- Printing: www.ricoh.com/technology/tech/printing.html