

## Technology Strategy



Vice President and Executive Officer  
CTO, President, Power & Info Control  
Platform Business Unit and  
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### CTO Message

**We are enhancing human resource development and open innovation with an eye to establishing industry-leading R&D capabilities.**

#### Accelerating R&D Activities to Keep up with Changes in Technologies and Customer Environments

We at the Research & Development Group have been advancing the performance, durability and functionality of our machines by doing model updates every few years. We are now in the age of the connected vehicle, however, and must also keep up with the rapid progress in digital and communication technologies and changes in our customers' environments. To meet this requirement, we must speed up our development activities. In addition, whereas our technological challenges traditionally related to mechanical engineering, including hydraulic pressure and structures, more than half of our technological issues these days are related to software and communication technologies, making it essential that we develop researchers and developers who can address these issues and make effective use of open innovation opportunities to establish such technologies. Accordingly, we established the Open Innovation Promotion Office in April 2023, which has since been leading joint development projects with companies specializing in communication and software, including startups. We are also considering making more effective use of fast-evolving AI systems at our development sites. For example, our developers are considering the use of AI systems in our ICT construction machinery, specifically to improve their obstacle detection and machine control functions based on deep learning using images

captured by machine-mounted cameras. We are also starting to conduct examinations on using AI for the provision of solutions and support to our customers, including making ConSite data reports and deciding which customer to prioritize in making customer visits.

The external technological environment has also substantially changed over the past two to three years. For example, the advancement of automobile driving support technologies and their now widespread use is causing a drop in the market prices of light detection and ranging (LiDAR) sensors and ultrasonic sensors, facilitating the evolution of construction machinery. In response, our personnel engaging in development activities for construction and mining machines are now working even harder, recognizing that the time has come for them to incorporate their developments into new machines to be released on the market.

#### Making Steady Progress on Five Advanced Themes from Medium- to Long-Term Viewpoints

The Research & Development Group is tasked with the mission of consolidating technical requirements from each business unit, and leading and supporting value creation for the entire Group on a medium- to long-term basis. As our vision for 2030, we aim to establish industry-leading R&D capabilities. Accordingly, we set up five advanced R&D themes: improve safety, improve productivity, reduce life cycle costs, prevention of global

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warming and adapting to global polarization. We have already made progress and achievements on these themes.

First, we completed the development of a prototype full battery dump truck and shipped it out for a demonstration experiment, which we have been conducting under actual operating conditions at the Kansanshi copper and gold mine in Zambia since 2024. We developed this prototype by applying the proven technologies adopted for our dump trucks equipped with a trolley dynamic charging system. The battery-charged prototype can be recharged via an overhead power transmission line to drive the AC motor and will thus contribute to achieving net-zero greenhouse emissions from mining equipment.

Second, we announced the RBT series of hydraulic excavators that can be operated remotely. RBT stands for Ready to be ROBOT and refers to a “robot with no human operator on board.” We released the first two models of the series in May 2024. Unlike conventional remote-controlled machines, the two medium-sized hydraulic excavator models are controlled digitally via a network and can be utilized by our customers as a base machine on which a range of new technologies can be mounted. To achieve this, we collaborated with silex technology, Inc. to develop a new solution to overcome lags and disruptions in the transmission of camera images and operational signals, which is a major issue for remote-control technologies. Based on the solution, which we have developed by combining silex’s communication technology with our own know-how and data accumulated by working with our customers, we aim to further improve the operability and efficiency of the RBT series. We are planning to start a demonstration experiment for the solution within FY2024 to verify its specific effects.

We have also made progress in the development of self-driving technology. We conducted a joint experiment with general construction company Maeda Corporation and iXS Co., Ltd. on autonomous excavation using our ZCORE system platform-equipped hydraulic excavator. In the experiment, which lasted about four months from November 2023, we were able to build a generic interface between

the construction company’s system and our hydraulic excavator and verify its effect. I would say we are thereby one step closer to Hitachi Construction Machinery’s goal of achieving “cooperative safety” at construction sites, which refers to humans and machines working together safely for higher productivity.

## Creating “Co-Creation Places” for Open Innovation

These achievements have been made through open innovation activities, which we have been promoting in recent years, and through technological partnerships, which we have formed with business partners, startups, universities and others across industries and on a global scale based on our own hydraulic technologies as well as the electronics and advanced IT technologies possessed by Hitachi, Ltd. “Delivering innovative solutions for customer needs” is the first pillar of our current medium-term management plan, “BUILDING THE FUTURE 2025.” As a solutions provider, we deem it particularly important to not only make effective use of our technologies but to do so in a more open manner. We have therefore also been working to establish our own “co-creation places” throughout the fiscal year, with a view to providing our engineers who specialize in communication, image recognition, machine control and other technologies with even more opportunities to have dialogues with their counterparts at leading companies in various fields and to thereby identify more seeds for innovation.

As one of such places we opened the Orange Innovation Plaza in the engineering building of the Tsuchiura Works. The Plaza was completed in the spring of 2023, in time for us to hold the Hitachi Construction Machinery Innovation Summit 2023 there at the end of May. As many as 40 companies exhibited at the venue for the first-time event, with 110 exhibiting online. Visitors to the venue included representatives of an energy company with whom we had little contact in our day-to-day operations, and the event provided our

engineers with a valuable opportunity for communication.

Furthermore, in May 2024, we opened ZERO EMISSION EV-LAB in Ichikawa City, Chiba Prefecture. The development of our electric construction machinery has so far been led by German company KTEG GmbH, with the Tsuchiura Works also engaging in the development. Going forward, we will promote co-creation with our customers and business partners at the Ichikawa research base for the achievement of zero emissions at construction sites. Thanks to the cooperation of Isuzu Motors Limited, ITOCHU Corporation and Kyushu Electric Power Co., Inc., we now have a full lineup of battery-driven electric excavators at the research facility, as well as the portable charging equipment and construction equipment required for the achievement of zero emissions.

Also, in May 2023, we decided to form a capital partnership with aptpod, Inc., an IoT-related startup in Japan. By making use of this company’s high-speed IoT platform, we have started to develop a system to remotely control and automatically operate construction machinery by using their digital twins. For civil engineering, it is necessary to transmit and process topographic data at a high speed to reflect the changes in the physical environment that occur during on-site construction work. Due to the sheer volume of this data, it has previously been difficult to build digital twins of construction machinery that can operate in real time. The high-speed “intdash” IoT platform provided by aptpod enables users to transmit voluminous data at a high speed and in a stable manner. For us, it means we can now receive data from construction machinery and other on-site systems and process it to build real-time digital twins of the machines. We are now ready to press forward with a joint development with the startup using a range of real-world data.



Opening ceremony held for ZERO EMISSION EV-LAB

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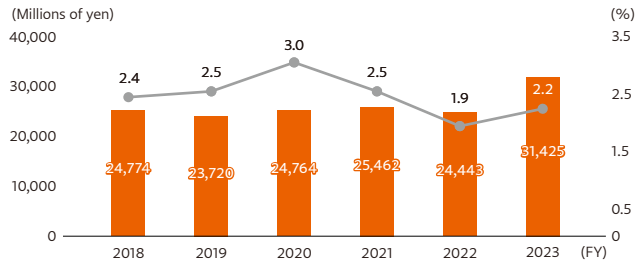
### Nurturing an Agile Corporate Culture to Offer More Value to Customers

Through the promotion of open innovation, we are adopting anew ideas from outside the company. We have also started to implement an initiative to transform our entire organization into one with an agile corporate culture. We previously developed a new product by identifying the needs of customers ahead of others and then releasing a perfected model. With customers these days attributing more importance to software functions in terms of product performance, we are responding by releasing products that can be updated over the air (OTA) via a network. We have already introduced an agile development process for ConSite and other services so that we can update the related software applications over time to shorten the development period. As a solutions provider, I think our next step will be to firmly establish an agile development method. We must also be able to promptly update our solutions for construction sites in order to provide direct assistance in improving site conditions. Based on this recognition, our development and sales teams will work in concert to provide customers with machines and solutions that both agile and ready to go, thereby earning the trust of our customers as their solutions provider.

As for R&D investment, we uphold the target of raising the ratio of R&D investment to sales revenue at least to 3% in the mid-term plan, as compared to the 2.2% recorded for FY2023. One of my important roles as CTO is to see that we reap the yields of R&D investment efficiently. To this end, I ensure that the Development Strategy Office works steadily to lead the formulation of a medium-to long-term technological strategy roadmap that describes R&D and product development plans, with a focus on the optimal allocation of budget and human resources. The Hitachi Construction Machinery Group has specified “Product and technology development contributing to climate change mitigation and adaptation” as one of its issues of materiality and aims to make its entire value

chain carbon neutral by 2050. Toward this goal, we have set our medium-term milestone targets and vision in reference to social, environmental and technological trends. We will make plans separately for our internal activities and for open innovation activities by backcasting from these targets and vision and will centrally manage the plans to avoid the duplication of development themes between business units.

#### ■ R&D Investment and Ratio of R&D Investment to Sales Revenue



### Adhering to the Principle of “No Hierarchical Relationships Regarding Technologies”

As I have already mentioned, digital technologies will be further sophisticated, making it an important management priority for us to develop engineers armed with the comprehensive expertise required of a construction machinery manufacturer that is engaging in the development of entire systems. Specifically, we must help our engineers gain comprehensive knowledge about construction machinery bodies and structures that meet customer needs and about how the machines are used at each construction site. To this end, we newly established the Power & Info Control Platform Business Unit. This

unit is tasked with developing technologies for hydraulic equipment, electronic control, transmission, software, and comprehensive body control systems and will manufacture the products that incorporate the developed technologies.

In recent years, a string of scandals involving manufacturers have been reported, reminding us of the importance of ethics to engineering. I have often repeated something my supervisors told me soon after I joined the company: “There should be no hierarchical relationships regarding technologies.” Engineers deal with physical phenomena, which occur regardless of whether you are an entry-level employee or a high-level manager. Engineers must therefore communicate as equals and with candid sincerity in order to maintain a strong ethical framework. For example, even if a product is designed and manufactured strictly according to specifications, its performance could still be lower than expected in an evaluation test or the product might even break. If such an incident occurs, the engineer in charge must communicate this frankly up the chain of command, and even unfortunate or disappointing test results must be collectively acknowledged. Maintaining an ethical approach to engineering is thus something we must continue to promote, along with the Group’s long-cherished *Kenkijin* Spirit.

We have been working to establish industry-leading R&D capabilities by the year 2030, which will soon be upon us. We have also formulated a technology strategy roadmap that more clearly shows our medium-term milestone targets and vision toward 2050. Further, we have set dozens of R&D themes, including those for remote control, automation, digital twins, ICT construction machinery, electric components, batteries, power management, longer-life components, advancement of ConSite, remote failure diagnosis and preventive maintenance, while making predictions about regulatory and policy trends in each country as well as about future technological advancement. Going forward, I will be working hand in hand with all members of the Group to make steady progress and become a true solutions provider.

## Technological Strategy Roadmap

Hitachi Construction Machinery is conducting research on more than 250 technological themes, which we summarize in a technological strategy roadmap as our vision for 2035. The themes are roughly divided into the following four categories: provision of solutions,

remote control and automation, environmental impact reduction, and life cycle cost reduction. We make examinations to decide on the development themes to be addressed internally and those to be addressed in cooperation with external parties, and then allocate the necessary financial and human resources to each of them.

## Intellectual Property Strategy

The Hitachi Construction Machinery Group attributes importance to intellectual property activities in its business. We set basic policies on the protection of intellectual property and respect for the intellectual property of other parties as part of the Hitachi Construction Machinery Group Code of Conduct and have been conducting intellectual property activities based on these policies.

The Intellectual Property Department is leading our intellectual property activities and promoting the formulation and implementation of intellectual property strategies in cooperation with the R&D and business divisions. We are also sharing intellectual property strategies among Hitachi Construction Machinery Group companies.

In view of the high share of overseas sales among our total sales, we attribute importance to having a global patent network and have been maintaining the ratio of our overseas patent applications at 30% or more of the total since FY2011. Further, we are enhancing patent activities for our value chain- and carbon neutrality-related technologies to elevate our intellectual property-related capacity to a global top level.

### Intellectual Property Education

In order to proactively create and protect our own intellectual property and respect that of others, the Hitachi Construction Machinery Group has been providing its employees with intellectual property education, which is regularly updated in response to legal and regulatory revisions and other changes.

Based on the recognition that employees require different knowledge about intellectual property depending on their job and rank, the Group is proactively providing them with rank-specific education, including holding basic seminars for entry-level employees and seminars on intellectual property leadership for mid-rank employees.

We will continue to conduct intellectual property education in and after FY2024, reviewing the contents as necessary.

### Technological Strategy Conceptual Diagram for 2035

