Achievements through Co-Creation with Clients in Solving Social Issues and Supporting Future Society

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As OKI enters the final year of its 2025 Medium-Term Business Plan, its purpose of existence, which is "solving social issues and supporting future society," is coming to fruition as concrete business results. Under its business slogan, "Steering toward growth 1st Stage," OKI has been honing solutions that address social needs, including resilience, sustainability, and security, by combining its manufacturing strengths with digital services, based on a deep understanding of on-site issues and co-creation with clients. These multidisciplinary achievements "co-created with clients," including remote infrastructure monitoring using zero-energy IoT, autonomous manufacturing and logistics, railway safety support, global on-site implementation, advanced technology implementation, and breakthroughs in semiconductor technology, are beginning to manifest in the market as tangible values. This comprehensive report focuses on "social infrastructure resilience crossed with zero-energy & digital" as a timely specific business. It comprehensively discusses market trends, OKI's vision, technological strengths, and future developments. It also presents an overall picture of the company's growth foundation through progress in related sectors.

Overall Picture of Market Environment: Multiple Crises and Opportunities Occurring Simultaneously

Aging social infrastructure, increasingly severe flood/landslide disasters due to climate change, a declining workforce and the challenge of skill transfer, geopolitical risks and supply chain restructuring, and increasing cyber/physical security threats are affecting all areas of life, from the public sector to industries. In the infrastructure field, remote/continuous monitoring and predictive maintenance systems are essential to ensuring resilience, and ultra-low power consumption and independent power supply technologies are becoming increasingly important at sites with strict restriction on power access and maintainability.

The railway field is also seeking advanced safety and security. There is growing demand for systems to protect people and equipment, such as fall detection on station platforms and monitoring around railroad crossings and tracks. In the water-related field such as rivers and dams, there is a strong demand for multi-faceted, continuous monitoring that is more advanced.

In the manufacturing/logistics field, achieving both autonomy and flexible response to supply/demand fluctuations is a key topic. While the adoption of AMR (Autonomous Mobile Robot) and vision AI is accelerating, on-site facilities are facing challenges such as managing multi-vendor setup environments and optimizing TCO. In the information and communications field, the shift to IP broadcasting is gaining momentum, necessitating the development of products/systems that meet quality, latency, and security requirements. In the office equipment/printer field, the strict environmental and security regulations mean that energy conservation, long life, and product security are essential.

In the semiconductor/electronics field, the explosive demand for AI has dramatically increased the difficulty of testing HBM and other wideband memories, making high-multilayer, large-format, and high-resolution printed wiring board technologies key to inspection equipment. At the same time, the combined performance, miniaturization, and heat dissipation through stacked integration of heterogeneous materials (advanced packaging) is becoming increasingly challenging, necessitating the development of solutions that leverage multidisciplinary co-creation. In the space equipment field, the need for high reliability and rapid thermal design/verification is growing. All these trends are leading to new opportunities for sustainable growth and social value creation for OKI due to its long-cultivated field expertise and advanced monozukuri (manufacturing) capabilities in the social infrastructure sector, as well as its shift to service delivery and global co-creation.

OKI Vision: Make Sites Smarter and Stronger with "Zero-Energy x Connectivity x AI"

OKI's goal is to make social infrastructures "smarter and stronger" by widely distributing sensors and communications to sites, including outdoor/remote areas with severe power constraints, enabling autonomous operation with zero-energy technology, and adding value with AI and data analysis technology. Specifically, OKI is focused on infrastructure monitoring, railway safety support, hydrological observation, and disaster risk visualization. Centered on its Zero-Energy IoT series, OKI designs/implements solutions tailored to local installation and operational conditions. OKI's design philosophy is based on origination of work on-site, client co-creation, and platform development. In manufacturing, OKI will differentiate itself through manufacturing based on common platforms and common substrates using in-house ASICs and power-saving technologies that has earned client trust for many years. From a business standpoint, OKI will promote the expansion of its service portfolio and provision continuous value through its service platform. Globally, OKI will accelerate implementation and commercialization in collaboration with local SI/sales partners and establish an APAC deployment model. The source of OKI's competitiveness is that these initiatives span the entire company starting with the sales department through its "One Team" promotion, and that everyone makes the "achievements through co-creation with clients" a personal responsibility.

The current status of core solutions that are leading implementation in the social infrastructure field and the next steps are discussed below.

1. Enhanced Zero- Energy IoT Series[1]

The Zero-Energy IoT Series is a platform for infrastructure monitoring that utilizes energy harvesting, such as solar power, to achieve long-term operation without battery charging or replacement. Included in the Series is the Zero-Energy Gateway, which is highly regarded for its stable operation in harsh environments and ease of installation/maintenance, leading to its widespread use for disaster prevention and infrastructure monitoring. However, in order to increase power generation/storage for high-volume data acquisition and improve operational stability in low-light environments, an enhanced prototype power supply was developed, achieving both improved power generation efficiency in low-light conditions and optimized power reception under bright conditions. This is expected to increase the resolution and accuracy of data acquisition, thereby improving the reliability of early warning detection and risk assessment.

2. Next-Generation Zero-Energy High-Sensitivity Camera[2]

For the next-generation zero-energy high-sensitivity camera, released in 2022, work is focused on improving the probability of successful captures in difficult lighting environments. Work will be carried out simultaneously to optimize the signal-to-noise ratio in low light, adapt to moving objects, twilight and backlit conditions, optimize power consumption, strengthen environmental resistance, as well as increasing the reliability of event detection by integrating images with data from other sensors. This will create new use cases for surveillance in areas with limited power and communication resources, such as along railway lines, rivers, and roads.

3. Railway Safety Support and River Monitoring

The railway platform fall detection system[3], co-created with a client, uses LiDAR sensing to detect dangerous conditions at the platform edge, and it has been put into operation at actual stations. Key evaluation points include the algorithm design, which enables stable detection in crowded conditions or when passenger flow fluctuates with the time-of-day or season, and the ease of maintenance and operation. For river monitoring[4], a technology for monitoring area-wide flow velocity over a wide area was developed using millimeter-wave radar. This established a technological foundation for continuous unmanned / minimal manpower monitoring. The system incorporates waveform processing, Doppler analysis, and disturbance tolerance to ensure the reliability required in the field and utilizes the collected data for value (e.g., input into flood prediction models and detection of river channel changes).

4. Global Implementation: Field Experiments in Turkey and Indonesia [5], [6]

During field experiments conducted in Turkey and Indonesia, the practicality of the Zero-Energy IoT Series in the railway field, as well as the appraisal and acceptance by infrastructure managers, were confirmed through on-site installation and operation. OKI is standardizing the design/implementation procedures to suit local communication conditions, installation environments, and maintenance systems, and is establishing templates and partner collaboration frameworks for future global expansion.

Furthermore, the co-creation with the Turkish Republic State Railways was combined with satellite image analysis technology, leading to the enhancement of disaster risk assessment, and OKI is accelerating social implementation through public support, including the adoption of subsidies.

Manufacturing/Logistics Digital Transformation: From One Factory to Market

In order to accommodate diverse industries/scales, OKI Group's factories are developing and applying RAT[7], a multi-vendor AMR control system. This reduces individual investment and time required for development at each factory, thereby enabling the achievement of One Factory. RAT is a platform that integrates and controls AMRs from multiple vendors, enabling flexible operation tailored to the site's traffic flow, mixed environments, and safety requirements. Its unique feature is the ability to define and optimize flow on a model basis, taking into account the entire lifecycle of installation, expansion, and maintenance. In strengthening the collaboration with domestic and international partners, OKI will consider the external sales and global expansion of RAT.

These efforts have created a chain of "personal responsibility" that allows solutions refined internally to be quickly applied to the market, accelerating OKI's ability to solve clients' on-site issues.

Evolution of Technology Foundations and Monozukuri: Platforms, Advanced Packaging, and High-Reliability Design

The common platform (CG1)[8] utilizing in-house ASICs is an initiative that simultaneously achieves shorter development times, reduced lifecycle costs, and improved reliability through product line standardization, power savings, and streamlined development/production. Standardization of the power supply and thermal design also contributes to improved efficiency of zero-energy equipment and enhanced environmental resistance for outdoor equipment. OKI has successfully developed a 124-layer, high-definition, large-size printed wiring board technology[9] compatible with next-generation AI semiconductor inspection equipment, achieving approximately 15% more layers than with conventional technology. Simultaneously achieving fine wiring, low via resistance, dimensional stability, and thermal diffusion

is an important breakthrough that supports inspection equipment performance in the AI era.

In advanced packaging, OKI is promoting co-creation in the fields of power semiconductors, analog ICs, and photonics through its CFB®[*1] (heterogeneous material bonding/integration) solution[10]. The co-creation projects with various companies contribute to the evolution of new semiconductors through vertically integrated optimization of materials, devices, processes, and design. In the space equipment field, OKI provides one-stop support for high-reliability development with its SimuValid™[*2], [11], which offers a comprehensive service ranging from thermal analysis and actual equipment verification to heat dissipation technology proposals and component-level cause analysis of abnormalities. Using OKI's proprietary process, the Migration Integration Service[12] enables rebuilding of aging systems with limited design assets while maintaining the same functionality and performance, thereby extending the lifespan of existing systems. For CATV IP broadcasting systems[13], OKI offers a lineup of products that meet the quality and operational requirements of IP broadcasting, including broadcast servers that comply with new standards and monitoring systems that comply with the Ministry's broadcast quality ordinance. For office printers, OKI has developed the new A4 monochrome LED printers B433/B533[14], which are already compliant with the stricter environmental and security regulations that will be imposed, providing customers with value through energy savings, longer life, compact size, and improved user maintainability.

Service Shift and Digitalization: Value Creation with Generative AI

The generative AI app Da Vinci Graph®[*3], [15] structures thinking and dialogue based on frameworks such as 3C/4P and intellectual property analysis. It then visualizes causal and semantic relationships in graphs, thereby accelerating both internal and external innovations. Sales, development, manufacturing, and service functions share insights through a common knowledge graph, increasing the speed and accuracy of processes from problem definition to hypothesis testing and value proposals. With Global Innovation Hub[16] literally serving as a hub for each function, global expansion in collaboration with local SI and sales partners is taking shape, creating a system for rapidly incorporating knowledge of local requirements, regulations, and operations.

Achievements with Clients: Co-Creation, Implementation, and Expansion

Social issues are unique to each site, and solutions emerge through co-creation with clients. The co-created railway platform fall detection system is a practical example of contributing to urban railway safety and will serve as the foundation for future horizontal deployment. The demonstration of a social infrastructure disaster prevention platform with the Turkish Republic State Railways combines satellite image analysis and Zero-Energy IoT to visualize and predict disaster risks. In increasing acceptance from infrastructure managers, OKI reaffirmed the crucial importance of implementation practices that include not only accuracy but also installation/operation/maintenance ease, cost-effectiveness, and data integration. For semiconductor and advanced packaging, OKI collaborated with material/device companies and academic institutions to address issues in next-generation power semiconductors, analog, and photonics. OKI's high-multilayer PCB technology in the inspection equipment field has provided a competitive edge directly linked to ensuring quality in the AI era. For manufacturing digital transformation, the combination of multi-vendor integration using RAT and hierarchical behavior recognition[17] has proven effective in achieving both on-site autonomy and human-centric improvements in safety and quality. This "one-stop" implementation that integrates sales, development, manufacturing, and service is proof that all internal stakeholders, including the sales department, have taken "personal responsibility" of projects and contributed to achieving results.

Future Development and Deployment: Stronger, Broader, Smarter

In OKI's future development, anticipation of "non-functional requirements" such as data governance, cybersecurity, and safety standards, and incorporation of operational design for local implementation (human factors, maintenance design, lifecycle costs) will be the top design requirements. Through contributions to standardization and reference architectures, OKI will actively participate in the formation of an international ecosystem for resilience and disaster prevention.

Supporting the Future Starting with On-Site Co-creation

Social issues cannot be solved by a single product or technology. OKI will pass along the "achievements through co-creation with clients" to the next site, the next country, and the next region, and persistently implement resilience, low environmental impact, and safety/security that will support future society. OKI's strengths lie in its deep understanding of social infrastructure issues, its reliable monozukuri, and its commitment to co-creating values with clients. Over the three years of its Medium-Term Business Plan 2025, OKI's "Steering toward growth 1st Stage," centered around "Zero-Energy x Connectivity x AI," built a track record of cross-sectional proposal and implementation capabilities spanning infrastructure, manufacturing, semiconductors, communications, offices, space and healthcare, as well as cultivation of co-creation with clients. OKI's "personal responsibility" culture, in which all employees in sales, development, manufacturing, and service are involved in creating value from their own sites, is the driving force behind the achievements through co-creation with clients. Moving toward the next stage, OKI is determined to further expand on-site co-creation as a partner in solving social issues and supporting future society, and to contribute to the realization of a safer, more sustainable, and more prosperous society through the integration of technology, services, and global implementation. ◆◆

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【Glossary】

HBM (High Bandwidth Memory)
Next-generation memory that achieves ultra-high bandwidth using stacked DRAM. It is a storage technology used in AI semiconductors and high-performance computing applications.

ASIC (Application-Specific Integrated Circuit)
An integrated circuit designed and optimized for a specific application. It has advantages over general-purpose ICs in terms of performance, power consumption, and cost.

LiDAR (Light Detection And Ranging)
A sensing technology that irradiates an object with a laser beam and measures the reflected light to obtain distance and shape. It is used for spatial recognition and safety monitoring.

RAT (Robot Arm Transporter)
The name of OKI's multi-vendor AMR control system. A platform that provides integrated operation and management control of AMRs from different manufacturers.

PCB (Printed Circuit Board)
An abbreviation for printed circuit board. A substrate for mounting and electrically connecting electronic components.

CFB (Crystal Film Bonding)
OKI's proprietary technology that bonds different semiconductor materials using only intermolecular forces, dramatically improving the performance of electronic devices.

Global Innovation Hub
A combination of global and innovation teams.