# Manufacturing Capital

## Outline of Efforts to Strengthen Manufacturing Capital

DENSO's strength lies in manufacturing foundations that the Company continuously evolves through production technology innovation and on-site improvements. We have accumulated an abundance of excellent manufacturing capital that includes a network of production bases throughout the world and organizations and employees with the expertise and skills needed to implement and realize initiatives. We will build a global production and supply system that can both adapt to uncertain external conditions and keep pace with the operational changes accompanying the revolution resulting from the increased production of connected, autonomous, shared & service, and electric (CASE) vehicles. At the same time, we will pursue ambitious, new-era manufacturing initiatives that address such social issues as environmental regulations and population decline. We will also evolve plants by establishing DENSO-style digital-twin plants that facilitate continuous improvement. This evolution will be achieved by combining our long-standing creative prowess—made possible by employees' collective knowledge and efforts —with scientific, data-enabled analysis capabilities.

## Characteristics of DENSO's Manufacturing Capital (Fiscal 2024 results)

Capital expenditures ¥394.6 billion

Total CO<sub>2</sub> emissions **50% reduction** (compared with fiscal 2021)

Number of regional production bases worldwide 127 plants in 25 countries

## Manufacturing Capital Strengths and Strategies

To create new value and sustain growth in an era of rapidly changing conditions, further improvement of the manufacturing capital that we have accumulated to date is essential.

Anticipating changes in external conditions and risks, DENSO will realize forward-looking measures by leveraging accumulated strengths. Specifically, we will take advantage of our global production and supply capabilities—the result of a basic policy of manufacturing close to markets and customers—and our plants, which continuously create value by using advanced technologies and production sites to realize appealing products.

With respect to our global production and supply capabilities, we will replace portfolio businesses in line with the progress of the CASE revolution while optimizing production and supply capabilities in each region by shifting to growth businesses and consolidating production globally and within regions. In conjunction with these efforts, DENSO will bolster business continuity capabilities through bridge production, the maintenance of high-risk inventories at appropriate levels, and other measures. These measures will ensure stable production even in volatile conditions, thereby minimizing costs. In addition, we will build a resilient supply chain by taking on the challenge of addressing social issues, such as a declining and aging workforce and Japan's "2024 logistics problem" (shortage of truck drivers).

Meanwhile, we are strengthening our plants by accelerating initiatives aimed at carbon neutrality and productivity improvement initiatives that are based on data analysis and production line automation and by strategically investing in CASE-related projects and production infrastructure. Also, with our sights set on the period from 2030 to 2035, we will introduce innovative production lines to such growth fields as vehicle electrification. Further, we will boost engineering and the development of production technologies in relation to the hydrogen business and other new business fields and the manufacturing circular economy (utilization of recycled materials) by employing original technologies and advanced skills developed for internal combustion engine products. DENSO will continue undertaking ambitious initiatives aimed at establishing ideal plants through the realization of such goals as 24-hour unattended operations, fully digitalized operations, and complete carbon neutrality.

## **Global Production and Supply Capabilities**

In line with its principle of manufacturing in close proximity to customers, DENSO has built highly competitive production structures in six countries and regions: North America, South America, Europe, Asia, China, and Japan. At our production bases worldwide, we aim to achieve leading levels of quality, cost, and delivery in each region. As well as reweighting our business portfolio to accommodate the CASE revolution, we are currently building a production and supply system with a resilience to change and fluctuation that enables stable delivery of products to customers even amid various geopolitical risks. For growth businesses, we aim to build a worldwide production system and raise production capacity. As part of these efforts, we will step up the manufacture of inverters-a key product for vehicle electrification-by seeking an early transition from internal combustion engine plants to electric vehicle component plants and by pursuing a plan to supplement existing production capabilities in Japan, North America, China, and Europe through the establishment of inverter production in other parts of Asia. (Overview by Product: Electrification Systems TTP.82-83

In Japan, DENSO will take the lead in solving the shortage of truck drivers in the supply chain that connects suppliers, production bases, and customers and in reducing CO<sub>2</sub> emissions resulting from the transport of materials and products. Rather than leaving supply chain matters solely to transportation companies and suppliers, we will take the initiative and streamline and digitalize the entire supply chain. We will establish and then roll out best practice for improvements in delivery logistics, which deliver products to customers; cargo handling operations, which form packing styles throughout the supply chain; and procurement logistics, through which component deliveries are received. DENSO Integrated Report 2024 Capital Strategies

## DENSO-style Digital-twin Plants

In DENSO-style digital-twin plants, people play leading roles. To create even better products and production lines, we have built a robust manufacturing foundation through Excellent Factory (EF) activities in which all employees participate on a daily basis. We will transform workstyles so that employees engaged in onsite production constantly evolve operations by actively utilizing on-site data and by combining their creativity, realization capabilities, and intrinsic abilities.

DENSO is developing a globally integrated data infrastructure by deploying in-house-developed Factory-IoT (F-IoT) systems to domestic and overseas Group companies and linking the systems. We are making steady progress in laying the foundations for digital-twin plants through these ambitious efforts to further advance our connected environment, which encompass software workshops to promote application development that originates from frontline operations, the training of personnel

with digital technology literacy, the accumulation and utilization of Al-enabled expertise (knowledge Al), and the distribution of digital terminals to all on-site employees (distribution completed to the approximately 20,000 on-site employees of DENSO CORPORATION).

In the digital transformation era, DENSO remains focused on quality. For big data analysis and improvement, we have developed our own digitally transformed version of the Seven Basic Tools of Ouality Control (OC7 tools), which we refer to as "DN7." Moreover, we have not only introduced DN7 in-house but also made it publicly available through open source platforms. In addition, we are actively fostering junior personnel with expertise in data science and helping promote the practical introduction of digital technologies to the manufacturing industry. For example, a DENSO employee has become the first person to earn a data science doctorate in Japan.

How We Envision Manufacturing Sites in the Digital Transformation Era



Data-driven Process Improvement Initiatives—Leading Monozukuri Quality Improvement in the Digital Transformation Era DENSO is utilizing data to achieve new improvements in processes. Quality control at our production sites centers on QC7 tools, which collect, organize, analyze, and visualize various types of data related to manufacturing processes and quality. However, directly handling the large amount of data generated in each manufacturing process with conventional QC7 tools is challenging.

To solve this problem, DENSO has developed an application called "DN7" that provides a new set of QC7 tools for the digital transformation era. DN7 enables data-driven approaches to process improvement that create unprecedented new analytical value. The application processes large amounts of data so that it can be viewed and considered, enables immediate discernment of changes, identifies trends in the performance of all products, and automatically narrows down critical factors that cause defects. Our goal is not simply to have Al come up with all of the answers. Instead, we want to create further improvements by using data to support and augment the capabilities of on-site personnel and establish an interdependence between human ingenuity and data analysis.

In the digital transformation era, our commitment to quality is unchanged. Aiming to elevate the level of quality throughout the industry, we have made the in-house-developed DN7 publicly available through open source platforms. Feedback and suggestions from external experts have allowed us to hone and enhance the DN7 in a short period of time, helping to accelerate its deployment both inside and outside the Company. DENSO has received a great deal of positive feedback from users both inside and outside the Company to the effect that they have been able to solve chronic issues, change workflows, and benefit from using the full range of functions made available through open source platforms. By evolving and rolling out the DN7 tools, we will continue providing value in line with society's current needs and leading Monozukuri quality improvement initiatives that transcend organizational boundaries.

## Example of the New Value Created by DN7



Message from the Chief Monozukuri Officer

## DENSO Monozukuri: Addressing Social Issues and **Realizing Employee Happiness**

## Jiro Ebihara

Senior Executive Officer Chief Monozukuri Officer (CMzO)

In accordance with our green and peace of mind principles, I believe that the roles of manufacturers in addressing social issues at home and abroad have been, are, and will continue to be the development of advanced technologies and the establishment of stable production and supply systems. DENSO's global resources for technology development and for production and supply are expected to play major roles in addressing social issues. At the same time, we cannot realize these roles unless our employees worldwide are satisfied with their jobs and are happy. Mindful of its roles, DENSO aims to make itself indispensable not only to direct customers but to society as well. To this end, in fiscal 2025 we will conduct production activities with an emphasis on the following two goals.

## 1. Realizing *Monozukuri* That Contributes to an Energy-recycling Society

DENSO is already steering toward production free of CO<sub>2</sub> emissions to become carbon neutral by 2035 without the use of carbon credits. We are advancing ambitious initiatives that lead the way in the manufacturing industry's utilization of energy. For example, we are changing over to manufacturing methods that incorporate hydrogen utilization technologies to save

## Example of Value Creation

## Logistics Reform Aimed at Both Solving the Logistics Labor Shortage and Achieving Business Growth

In response to the emerging social issue of logistics worker shortages, DENSO is advancing measures to create lean, worker-friendly logistics workplaces throughout the supply chain, extending from suppliers to customers.

For product delivery logistics, we have achieved a 34% reduction in the number of drivers required by introducing double articulated trucks, especially for long-distance transportation. In addition, we have adopted a truck transfer system to eliminate long working hours for drivers and improve their workstyle. Other initiatives include our construction of a highly efficient logistics network that uses the shortest routes and the minimum number of drivers. We are building this network through the inhouse development of an optimal transportation route design system enabled by guantum computers and AI technologies. (Our Cultivated Strengths P21)

As for in-plant logistics, we have standardized cargo handling operations that were reliant on workers' experience-based know-how\* and independently developed an AI technology-enabled algorithm for the calculation of optimal packing styles. A proving test of these in-plant logistics technologies at the Daian Plant confirmed reductions of 36% in product shipment work processes and 40% in the truck stoppage time of logistics partners.

other companies. Also, DENSO is working on joint utilization of logistics relay sites and creating a system for the development and utilization of optimal logistics infrastructure for society as a whole.

cient logistics.

\* Highly experienced workers' skills that are difficult to translate into a standardized manual



energy while meeting energy demand. In addition, we will develop materials and processing technologies for the realization of a resource-recycling society (circular economy), which has recently become a focus of attention. Our employees in Japan and overseas will collaborate to develop technologies that address social issues. (Our Cultivated Strengths, Special Feature: Value Creation in Action P.23, 94–95

## 2. Passing on the Significance and Enjoyment of Monozukuri and Developing Human Resources in a New Era

In every age, the realization of new value has stemmed from new Monozukuri technologies. I believe that the increasing integration of digital technologies and Al into society will bring about unprecedented innovation in Monozukuri. Such innovation will be driven by human ingenuity: our employees' skills will be needed to initiate and realize breakthroughs. Personnel engaged in DENSO's Monozukuri will derive job satisfaction from an awareness of their role in creating new value that addresses social issues. This sense of purpose will make DENSO a place where people want to continue working, which in turn will drive the Company's Monozukuri forward.

Reducing the number of required drivers by introducing double articulated trucks



In component procurement logistics, we have demonstrated a 30% improvement in loading efficiency through joint transportation with

DENSO will continue to take on the challenge of solving social issues in logistics by working with various partners to realize highly effi-