Through all processes of the value chain, Mazda pursues innovation that leads to the resolution of social challenges. To achieve maximum effects in implementing innovation initiatives, such as next-generation product technology development and production technology development for Monotsukuri Innovation, Mazda has been enhancing collaboration with business partners, universities/research institutions, and administrative organs.

Innovation to Pursue the Mazda Brand

With the aim of developing innovative vehicles that exceed the expectations of its stakeholders, Mazda has promoted company-wide efforts to review the vehicle-manufacturing processes from scratch. In FY March 2016, these efforts were highly appreciated both inside and outside Japan [see p. 12].

Innovation in Base Technologies “SKYACTIV TECHNOLOGY“

The basic policy of Sustainable Zoom-Zoom [see p. 2], Mazda’s long-term vision for technology development, is to provide all customers who purchase Mazda vehicles with driving pleasure as well as outstanding environmental and safety performance. To achieve this, Mazda is engaged in research and development aimed at creating the world’s best functions with the maximum efficiency. SKYACTIV TECHNOLOGY*, which the Company has introduced to its models since 2011, has achieved comprehensive improvements in base technologies, such as enhancing the efficiency of powertrain components including the engine and transmission, reducing vehicle body weight, and improving aerodynamics. In developing SKYACTIV TECHNOLOGY, much focus was placed on enhancing collaboration among Mazda’s various internal divisions/departments, as well as among Mazda and external suppliers and universities/research institutes.

Innovation in Vehicle-Manufacturing Processes through "Monotsukuri Innovation"

In line with its efforts to satisfy diverse customer needs and attract many customers by manufacturing vehicles that embody Sustainable Zoom-Zoom, Mazda is working to significantly improve its business efficiency by increasing product development/manufacturing efficiency. Upholding the objective of realizing both “diversity that enhances product competitiveness” and “commonality that improves manufacturing economies of scale” at a high level, Mazda launched “Monotsukuri Innovation,” an initiative to review all vehicle-manufacturing processes from scratch, and is promoting it on a global scale. The integrated planning initiative of the Monotsukuri Innovation involves close collaboration among product development, manufacturing and purchasing departments, as well as suppliers. They plan together the models to be introduced in the future across the vehicle ranks and segments from a five or ten-year perspective. This initiative has resulted in improved quality, brand strength and profit margins, while enabling flexible response to requirements for manufacturing several models with different production scales and changes in production volume.

Mazda Digital Innovation (MDI)

Mazda has been pushing ahead with the Mazda Digital Innovation (MDI), an initiative aimed at reforming work processes by introducing the latest IT technologies. In MDI Phase 1 (1996-2008), the Company promoted innovations in product development and manufacturing processes by employing CAD/CAM technologies, contributing to the efficient development and production of new-generation models with SKYACTIV TECHNOLOGY. MDI Phase 2 began in April 2016, in response to the advancement of IT technologies and the diversification of customer needs. In this phase, the Company has expanded the target of the initiative from the product development and manufacturing fields to the entire value chain, including the fields of sales, service, purchasing and logistics, and is promoting innovations in these fields to address business challenges in the mid- to long-term.
New Control Technology for Responsive Driving and Enhanced Safety and Peace of Mind

Mazda has been pushing ahead with the development of SKYACTIV-VEHICLE DYNAMICS, a series of new-generation vehicle motion control technologies. These technologies provide integrated control of the engine, transmission, chassis and body to enhance the car’s Jinba-ittai*1 driving feel—a sense of connectedness between car and driver that distinguishes Mazda vehicles. The first in the series, G-Vectoring Control (GVC), was released in May 2016. GVC is the world’s first control system to vary engine torque in response to steering inputs in order to provide integrated control of lateral and longitudinal acceleration forces and optimize the vertical load on each wheel for smooth and efficient vehicle motion.*2 Optimizing the load on each tire brings the movements of the car more in line with the driver’s intentions, reducing the need for steering corrections, including many that are made unconsciously. This helps reduce driver fatigue on long drives and makes changes in the acceleration forces acting upon vehicle occupants smoother, reducing torso sway and making for a more comfortable ride. In addition, GVC significantly improves handling and stability on wet, snowy and unpaved roads.

*1 Mazda’s unique driving philosophy, literally, “rider and horse, are one.” Mazda aims to create oneness between the car and the driver, just as a horse and rider communicate through feeling, thereby realizing the very best driving experience.

*2 As of June 2016, according to Mazda data

i-ACTIV AWD, a 4WD System Combining Excellent All-road Ability with Outstanding Fuel Economy

Mazda has developed i-ACTIV AWD, a new-generation all-wheel-drive system designed to provide safety and comfort in any driving conditions, such as on rainy highways or a snowy mountain roads, while minimizing fuel consumption. i-ACTIV AWD detects tiny signs of front wheel slippage that a driver cannot feel and proactively controls the distribution of torque between front and rear wheels to eliminate wasteful tire slippage. Using many sensors to accurately detect the driver’s intentions, road and driving conditions that can affect tire slippage, i-ACTIV AWD instantaneously calculates the optimal amount of torque and transmits it to the rear wheels. This enables secure take-off, acceleration, cornering and braking, without letting the tires slip in any direction. On dry road surfaces with good traction, the car works almost like a front-wheel-drive vehicle and achieves what was long considered difficult for 4WD systems: excellent all-road ability and outstanding fuel economy.
Design Theme, KODO – Soul of Motion

Mazda sees a car not as an object, but a living entity. The Company wants to make the relationship between driver and car one based on emotion, like that of a horse and rider. Therefore, a car cannot be a simple tool; it must have the vitality, expressiveness and power of a living creature. In order to realize this ideal, the Company announced the KODO—Soul of Motion design theme, which brings cars to life, in 2010. This design philosophy has been applied to all new-generation models globally since the Mazda CX-5 launched in 2012, and has been highly acclaimed around the world. (see p. 124)

The Future of Mazda Design – Mazda RX-VISION

Believing that heart-stirring beauty and the depth of an artifact made with soul are necessary to sublime the philosophy of KODO—bringing cars to life—to an even higher level, Mazda has proposed an ideal of the “Car as Art.” In a tenacious quest for beauty, the Company has sought artistic forms that can only be created by the human hand*1. Honing its expression of beauty, the Company embodied this in the Mazda RX-VISION rotary-powered sports car concept unveiled at the Tokyo Motor Show in the fall of 2015. Mazda aimed to give it the beautiful, flowing proportions unique to an orthodox FR*2 sports car and a form reflecting Japanese aesthetics, such as a dignified feeling of tension and suppressed glamour produced by stripping away unnecessary elements. The Mazda RX-VISION design, which represents the future of Mazda design, has gained critical acclaim worldwide. *3

*1 Even in this age of digital design, Mazda devotes great effort to design development using industrial clay models crafted by human hands.
*2 Front-engine, rear-wheel-drive layout
*3 Awards: 2016 Car Design Award (concept car category): A world-renowned award originally launched in 1984 and resurrected in 2016 after a 19-year suspension. An 11-member jury of editors representing high-profile car magazines on four continents selects the winners from vehicles presented during the past year in the categories of mass-produced vehicles, concept cars, and brand design.
Establishing a Global Production Framework

To enable each production site both in Japan and overseas to carry out high-quality and highly efficient production activities that improve the Mazda brand value and learn from each other at the same time, Mazda has promoted the Global Manufacturing Network since 2013. Production sites in Japan (the Hiroshima and Hofu Plants) take the initiative in fostering skills in process management and improvement (“workplace capabilities”) to enable overseas sites that differ in maturity to conduct production activities at the same levels of quality and efficiency. Programs set at each site facilitate simultaneous, even, and high-quality production during the preparation phase of mass production of new models, in addition to daily production activities.

In promoting this initiative, Mazda has held Global Manufacturing Forum annually since 2014 to share its medium to long-term goals, as well as successful examples and problems of each of its sites. In March 2016, the third Global Manufacturing Forum was held in China.*1 To support overseas sites in improving their workplace capabilities in daily practices, the Company actively hosts various forms of personnel exchange, such as accepting trainees in Japan from overseas sites and dispatching skilled personnel to overseas sites.

Establishing Global Logistics Framework

Mazda has established a global logistics framework involving overseas logistics sites. To enable optimal transportation in terms of delivery time, cost, and the quality of finished vehicles and parts on a global basis, the Company encourages the logistics sites to share problems related to means or routes of transportation and successful cases of improvement. The Company also holds a Global Logistics Meeting annually, in order to reinforce ties within the entire Mazda Group.

*1 Held overseas for the first time at Changan Mazda Automobile Co., Ltd. (CMA), a vehicle production site in Nanjing.

**VOICE**

Press Mold Maintenance Training Workshop
Master Trainer
Lu Ning

Having completed the press mold maintenance training program at the Hiroshima Plant in Japan, I was appointed as a master trainer in March 2016. I will make full use of the knowledge and skills I have acquired at the Hiroshima Plant to improve the CMA workshop and develop its trainers, and hand down the skills of meticulous press mold finishing that can give shape to the KODO design in Mazda vehicles.
Promoting Global Alliance

In order to strengthen the Mazda brand, Mazda is actively pursuing an alliance strategy that will mutually complement our products, technologies, and regions. In FY March 2016, vehicle production was started for Toyota Motor Corporation at Mazda de Mexico Vehicle Operation and for Fiat Chrysler Automobiles (FCA) at the Hiroshima Plant. In May 2015, Mazda and Toyota concluded a basic agreement to build a mutually beneficial long-term partnership that will leverage the resources of both companies to complement and enhance each other’s products and technologies. Through discussions by the examination committee, the two companies are deepening their mutual understanding and seeking an appropriate partnership from a medium to long-term perspective.

Basic and Applied Research on Technologies for Internal Combustion Engines and Cleaner Exhaust Emissions

Mazda participates in the Research Association of Automobile Internal Combustion Engines (AICE*1), a new joint research organization in the Japanese automobile industry. AICE was established on April 1, 2014, to enable automobile manufacturers to conduct basic and applied studies jointly with universities and research institutions on themes common to automobile manufacturers, and to use the research results to accelerate their in-house development activities. Taking advantage of its participation in AICE, Mazda is promoting its development of technologies for internal combustion engines and cleaner exhaust gases, with a view to achieving improved fuel economy and reduced exhaust emissions.

Collaboration with Suppliers

Technology Development in Collaboration with Suppliers

Mazda collaborates with suppliers from the early stage of product/technology development. To make this collaboration successful, the Company takes steps to promptly brief suppliers on medium to long-term business strategies and on matters related to sales and production, and arranges opportunities for the exchange of information closely. As the functions expected of a vehicle are becoming increasingly advanced and diversified, vehicle structures and control systems are becoming increasingly complex. To enable the speedy development of such complex systems with limited resources, Mazda promotes Model Based Development, an approach to conducting development efficiently on a desktop, using the technologies of suppliers.

Improving the Efficiency of Development and Operation of Systems

Mazda promotes the development of globally applicable systems, with the aim of improving the efficiency of development and operation. To enable itself to quickly respond to changes in business trends, the Company is renewing its development program. This initiative is promoted jointly with IBM, Oracle and other suppliers possessing leading-edge IT technologies.

*1 Research Association of Automobile Internal Combustion Engines, participated by nine Japanese auto manufacturers and two organizations (as of April 2015).
Activities to Improve Manufacturing Capabilities in Collaboration with Local Suppliers

Mazda is rolling out its J-ABC ("local") Achieve Best Cost program for local suppliers in and around Hiroshima Prefecture starting in 2004. Under this program, Mazda staff visit suppliers’ plants and use the approach employed in Mazda production systems as a basis for identifying wasteful, unnatural or problematic manufacturing processes. The Company then works cooperatively with the suppliers to formulate and implement countermeasures. This program is also expected to enhance potential for improvement at manufacturing sites in connection with Mazda’s Monotsukuri innovation activities [see p. 115]. It has helped increasing productivity and reducing production costs by 2 to 3 billion yen per year.

Results of J-ABC activities for FY March 2016

<table>
<thead>
<tr>
<th>Case Example</th>
<th>Objective</th>
<th>Initiative</th>
<th>Results for FY March 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperative Improvement Efforts</td>
<td>Improving operation rates, shortening cycle times, improving logistics operations (started in 2004)</td>
<td>A total of around 2,000 visits to 49 plants at 24 companies were carried out to implement cooperative improvement activities</td>
<td>Held 53 result-reporting meetings</td>
</tr>
<tr>
<td>J-ABC Karakuri Kaizen Dojo</td>
<td>Fostering high levels of creativity and making work more fun without incurring additional costs (launched in 2006)</td>
<td>Offered practical programs such as lectures and on-site guidance meetings to improve the ability to devise mechanisms for increased productivity</td>
<td>15 participants from ten companies successfully completed the program</td>
</tr>
<tr>
<td>J-ABC Maintenance Workshop</td>
<td>Preventing facility stoppages and drops in production capability (launched in 2010)</td>
<td>Practical programs such as lectures and on-site guidance meetings were offered to improve the ability to both detect and properly respond to irregularities</td>
<td>Held twice a year in the Hiroshima and Hofu districts, with a total of four members from four companies successfully completing the program in FY March 2016</td>
</tr>
<tr>
<td>J-ABC Conference</td>
<td>To encourage study through the sharing of J-ABC activity policy and outstanding activity examples (started in 2005)</td>
<td>Held for all participating companies, providing a venue for presentations, awards, and other events.</td>
<td>The 2015 conference was attended by a total of 470 participants, with 270 participants from 50 local suppliers and 100 participants from Mazda</td>
</tr>
</tbody>
</table>

**Activities to Improve Manufacturing Capabilities in Collaboration with Overseas Production Sites and their Local Suppliers**

As the importance of overseas production sites increases along with its attempt to establish a global production footprint, Mazda is promoting activities to improve manufacturing capabilities, with a view to improving quality and productivity jointly with local suppliers. While paying respect to the differences in national characters and cultures and understanding the key points necessary to promote continuous improvement activities at worksites, the Company employs the know-how obtained through the J-ABC activities. The Company has also established a system to develop leaders at both local production sites and suppliers in promoting activities to support improvement of suppliers. Mazda will continue to expand the activities in cooperation with its suppliers.

**A-ABC activities in Thailand**

In February 2013, Mazda launched the A-ABC (ASEAN Achieve Best Cost) program at AutoAlliance (Thailand) Co., Ltd (AAT). Three Mazda representatives in charge of the J-ABC program and three AAT promotion representatives serve as facilitators in conducting activities alongside seven local suppliers. As the contribution of the activities under this program to improving quality, productivity and cost performance has been gradually gaining recognition among other suppliers, the number of participating suppliers has reached nine to date in 2016. This program is designed to have each supplier envision an ideal, understand and analyze the present situation, develop and implement measures for improvement toward realizing said ideal, and finally report the results. It is carried out twice a year.

The A-ABC conference is held annually, to encourage communications and information exchange among participants. The representative of the supplier that won the highest prize at the conference gives a presentation on the supplier’s activities at the J-ABC conference held in October. Three representatives who had served as leaders of the activities gave confident presentations in front of an audience of around 300 including managers of Japanese companies including Mazda and the J-ABC promotion members.

**M-ABC activity in Mexico**

Mazda de Mexico Vehicle Operation (MMVO) launched the M-ABC (Mexico Achieve Best Cost) program in 2015. One Mazda representative in charge of the J-ABC program and two MMVO promotion representatives serve as facilitators in promoting activities in cooperation with two local suppliers.

The first results-reporting meeting was held in March 2016, where achievements leading to stable quality and stable supply were presented. With two suppliers newly joining in May 2016, four suppliers are presently conducting activities. Local promotion members are called national staff. National staff members are encouraged to autonomously and independently operate the program.

To this end, Japanese management of MMVO and its suppliers are making joint efforts to facilitate autonomous operation.
Mazda Sustainability Report 2016

Mazda, establishing the Industry-Academia-Government Collaboration Secretariat, has promoted collaboration with government authorities and universities, aiming to resolve business issues by obtaining new knowledge and viewpoints from outside the Company, and thereby broadly contributing to society. By visualizing such collaborative activities and sharing relevant information with government authorities and universities, the Company aims to achieve the maximum outcomes from its daily efforts. Moreover, Mazda, through collaboration with government, academia and industry, has contributed to the local community in terms of recruitment of local people, human resources development, and the production of human resources.

■ Participating in World-Leading National Projects and Joint Studies

Mazda participates in world-leading national projects and joint studies with external research institutions, with the aim of solving social problems facing the automobile industry.

<table>
<thead>
<tr>
<th>Relevant government institutions/organizations</th>
<th>Project name</th>
<th>Outline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Economy, Trade and Industry / New Energy and Industrial Technology Development Organization / Thermal Management Materials and Technology Research Association</td>
<td>Research and development on innovative technology to utilize unused thermal energy <a href="http://www.thermat.jp/english/">http://www.thermat.jp/english/</a></td>
<td>Research on technology to make use unused energy*1 released as thermal energy into the atmosphere</td>
</tr>
</tbody>
</table>

*1 In Japan, refers to the energy consumed in the living environment, industry, and transportation fields and released as unused heat energy into the atmosphere.

Industry-Academia-Government Collaboration in Hiroshima

As a company with its development and production facilities based mainly in Hiroshima Prefecture, Mazda believes that cooperation with local business and industry is very important. Under this belief, Mazda is collaborating with the Chugoku Bureau of Economy, Trade and Industry, Hiroshima Prefecture, Hiroshima City, Hiroshima Industrial Promotion Organization, and Hiroshima University to support local automobile-related companies and promote innovation and the vitalization of the region. The 2030 Industry-Academia-Government Collaboration Vision was established in January 2015. The six member organizations cooperate in seeking out new frameworks to support local businesses and investigating next-generation automotive societies.

The 2030 Industry-Academia-Government Collaboration Vision

- Transform Hiroshima into a hub that attracts people seeking innovative automotive technologies and dynamic car culture, and a place that continually produces technologies that amaze the world.
- Industry, government and education sectors work together to nurture human resources capable of innovation across all generations, and enliven the region through Monotsukuri (product development and manufacturing).
- Develop Hiroshima’s unique Industry-Academia-Government Collaboration into a leading model for “regional empowerment” in Japan, serving also as a benchmark for the rest of the world.

Establishment of Hiroshima Council for the Promotion of Collaboration between Government, Academia and the Automobile Industry

For the purpose of promoting the realization of the 2030 Industry-Academia-Government Collaboration Vision, the Hiroshima Council for the Promotion of Collaboration between Government, Academia and the Automobile Industry (hereafter, the “Hiroshima Automobile Council”) was established in June 2015. The Hiroshima Automobile Council has set up three committees and four specialized work groups to draw up the ideal to aim at for 2030, the goal for 2020, related measures, and road maps. Specific activities have also been started. The progress of the specific activities was reported to the Hiroshima Council representatives’ meeting held in January and July 2016. It was confirmed that the committees and work groups were making steady progress toward the ideal for 2030.
Business Matching Meetings for Suppliers and Universities
(Collaboration with Administrative Organs)

Mazda organizes business-matching meetings in collaboration with the local administrative organs, in which information on technological needs and seeds was exchanged between suppliers, universities and public research institutes. In FY March 2016, Mazda held meetings to disclose information on technological needs and business matching meetings in Nagano Prefectures, thereby strengthening the Company’s collaborative ties with the regions.

Collaboration with Universities

Through enhancing collaboration with universities in various fields, Mazda aims to solve a broader range of issues from a wider perspective, thereby contributing to society.

<table>
<thead>
<tr>
<th>University</th>
<th>Collaboration outline</th>
<th>Results for FY March 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hiroshima University</td>
<td>Concluded a comprehensive collaboration agreement in February 2011*1 to substantially expand the range of partnerships in the fields of product development and production, social sciences such as planning, management and marketing, and personnel exchange and human resources development.</td>
<td>• Implemented a broad range of joint research projects in engineering, science, and social science.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Continued the Center of KANSEI Innovation Nurturing Mental Welfare activities.</td>
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<tr>
<td></td>
<td></td>
<td>• In line with joint research projects, accepted 11 students for internship, providing them with an opportunity to see firsthand how engineers address various issues that arise in the process of business activity.*2</td>
</tr>
<tr>
<td>Kyushu University</td>
<td>Concluded an inter-organizational agreement in May 2011 to promote collaboration regarding next-generation automotive technologies. Working together to reinforce research and development projects and to encourage academic research and education activities.</td>
<td>• Implemented a broad range of joint research projects, mainly in engineering and science.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Held study and research meetings in advance of the joint research.</td>
</tr>
<tr>
<td>Kindai University</td>
<td>Concluded an agreement concerning comprehensive research collaboration in December 2012. Cooperating in bolstering cutting-edge research development and in strengthening the technological capabilities of local industries.</td>
<td>• Held meetings of the Research Collaboration Promotion Committee to discuss the progress of joint research projects and specific measures to strengthen cooperation.</td>
</tr>
<tr>
<td>University of Hyogo</td>
<td>Concluded an agreement on joint research using Spring-8, a large synchrotron radiation facility in May 2016. Cooperating in the development of innovative materials and product development technologies using radiation analysis techniques.</td>
<td></td>
</tr>
<tr>
<td>Tokyo Institute of Technology</td>
<td>Joined in the Industry Liaison Membership Program of the Tokyo Institute of Technology in August 2013, as the first step toward strengthening collaboration with universities in the Tokyo Metropolitan area</td>
<td>• Hosted technology counseling sessions and implemented joint research projects.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Participated in a poster session of the Advanced Technology Forum to exchange technological ideas.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Held a workshop at the Mazda R&amp;D Center Yokohama, inviting an ergonomics professor as a lecturer.</td>
</tr>
</tbody>
</table>

*1 Before February 2011, cooperated in research in the advanced automobile technologies.
*2 Accepted 106 students at Mazda in total.

Collaboration through the International Organization for Standardization (ISO)

As a member of the Japan Automobile Manufacturers Association, Inc., Mazda has joined the ITS (Intelligent Transport Systems) promotion activities. In the ISO Technical Committee 204, the Society of Automotive Engineers of Japan (JSAE) serves as the secretariat for the working group (WG14) in charge of the field of Vehicle/ Roadway Warning and Control Systems. In this working group, Mazda has undertaken the post of convener (Chair of the WG International Conference) since 2013, promoting the establishment of international standards for various safety drive assist systems, such as damage mitigation brake.