Executive Vice President
Koji Kobayashi

TPS and cost-reduction are Toyota’s backbone. I will pursue them on all fronts.

Executive Vice President
Shigeki Tomoyama

The key to realizing mobility services is connected technology. I hope that cars will continue to amaze and inspire for the next 100 years.

President
Akio Toyoda

It is time to unite globally as one Toyota to realize freedom of movement for all.

Executive Vice President
Didier Leroy

I want to bring Energy, Passion, and Fighting spirit to achieve true competitiveness.

Executive Vice President
Moritaka Yoshida

I want to continue making beloved cars that are as exciting to watch as they are to ride in.

Fellow
Gill A. Pratt

My personal mission is to help Toyota gain agility while maintaining its strength to improve quality of life for all mankind.

Executive Vice President
Mitsuru Kawai

Only by applying human wisdom and skill can we realize the evolution of machines—that’s why I would like to nurture our people.

Executive Vice President
Shigeki Terashi

I want to bring Energy, Passion, and Fighting spirit to achieve true competitiveness.
Using Connected Technologies to Expand the Freedom, Safety, and Excitement of a Smart Mobility Society

As cars rapidly developed and became commonplace in the 20th century, reducing fossil fuel consumption, cutting CO₂ emissions to prevent global warming, and preventing air pollution gradually became the major social issues demanding global solutions that they are today. In response, many counties and regions have made plans to shift to electrified vehicles, and automakers are accelerating the development of such vehicles. Indeed, the electrification of cars is an essential part of solving these challenges.

At the same time, new social issues are also emerging, such as increased traffic congestion due to rising population density in urban centers, shrinking working populations and increased numbers of mobility-challenged individuals in developed countries due to demographic graying, and deepening logistics crises due to changes in consumer behavior. In the midst of these social changes, the auto industry is entering a once-in-a-century period of profound transformation. Toyota provides freedom of movement—a form of social infrastructure. As such, we are firmly determined to contribute to solving social issues by changing the very ways that people, things, and information flow through the world.

Based on this commitment, Toyota aims to connect cars, people, and communities and thereby create a smart mobility society that offers freedom of movement, safety, and excitement for all.

Shigeki Tomoyama
Executive Vice President
Using Connected Technologies to Expand the Freedom, Safety, and Excitement of a Smart Mobility Society

Our Connected Strategy for Realizing Connected Platforms

Connecting cars is not only providing new value and services to customers, but creating new modes of use and new roles in society for cars.

To stay at the forefront of this evolution, Toyota established the in-house Connected Company in April 2016 and announced its Connected Strategy in November of the same year. This strategy comprises three arrows that we are releasing simultaneously.

1st Arrow
Connect All Cars

“Connect” all cars and complete the connected platform

Promote the use of big data and contribute to the good of customers and society while revolutionizing Toyota's own businesses

2nd Arrow
Creation of New Value and Business Revolution

Collaborate with various industries and IT companies to produce new mobility services

3rd Arrow
Creation of New Mobility Services

Toyota plans to adopt common standards for its worldwide DCMs by 2019, equip virtually all passenger vehicles it sells in Japan and the United States with DCMs by 2020, and steadily equip more vehicles with DCMs in other major markets around the world going forward.

Connected Technologies: Creating Services That Offer Safety and Peace of Mind to Customers and Society

Tuning to the second arrow, as the number of connected cars on the road increases, so does the big data they generate. Toyota is using this data to contribute to the good of customers and society while revolutionizing its own businesses.

Aggregate route history maps were made publicly available after the Great East Japan Earthquake, and such data has subsequently been used in evacuation, response, and recovery operations following several natural disasters.

Furthermore, by analyzing the diverse information collected from cars on the road using big data approaches, we will be able to utilize that information to create and enhance services that provide safety and peace of mind.

Route History Maps to the Rescue after Natural Disasters

Toyota’s route history maps use aggregate data on where cars have actually been collected from Toyota vehicles equipped with DCMs to provide traffic information in a map format. The data is constantly updated, and has been used to inform response during and efforts after natural disasters.

Services for Connected Cars

Voice Recognition-enabled AI Virtual Agent

Our voice-recognition service has evolved into an AI virtual agent. Merely by talking to the agent, users can set the destination for the navigation system, even while the car is moving.

e-Care (Driving Guidance)

• Indicator lights turn on when an abnormality occurs (Indicator light). Vehicle data is then analyzed (Vehicle data analysis), which guides the customer through any necessary action.

○ Operators hand over customer response to the customer’s dealer (Operator call screen), which guides the customer through any necessary vehicle servicing (Call and support).
Using Connected Technologies to Expand the Freedom, Safety, and Excitement of a Smart Mobility Society

Accelerating Cross-industry Collaboration as a Mobility Service Platform Provider

Under the third arrow, we are accelerating cross-industry collaboration through the Mobility Service Platform (MSPF). Using the MSPF, Toyota is taking an open approach, linking with all kinds of service providers to contribute to the creation of new mobility services.

We have already begun a range of collaborative initiatives. In May 2016, Toyota and Uber Technologies Inc. began to consider a partnership in ride-sharing. In 2017, we conducted a pilot program for our Smart Key Box with U.S. car-sharing company Getaround, Inc.; began a partnership with Grab Holdings Inc., the leading ride-hailing service company in Southeast Asia; and began verification testing of connected taxis with the Tokyo Taxi-Hire Association. In 2018, we are working to deepen these and other initiatives in order to create new mobility services and accelerate their commercialization.

Efforts to Deepen Collaborations in 2018

Expanded Partnership with Grab in the Area Mobility as a Service

In June 2018, Toyota concluded an agreement with Grab to strengthen our existing partnership in the area of Mobility as a Service (MaaS) in Southeast Asia and announced our decision to invest US$1 billion (approximately ¥110 billion) in Grab.

This expansion is aimed at expanding connected services across Southeast Asia. Specifically, we aim to achieve connectivity for Grab’s rental car fleet across the region and to utilize vehicle data collected by the MSPF to roll out driving-data-based automotive insurance as well as financial services currently under development.

Pilot Testing of AI-based Taxi Dispatch Support System

Aiming to Accelerate Service Development for Taxi Industry Transformation

Toyota, JapanTaxi Co., Ltd., KDDI Corporation, and Accenture Japan Ltd have partnered to develop a taxi dispatch support system that releases demand projections for taxi services based on a combination of data from taxi service logs, demographic data, event information and other inputs. Pilot testing of the system has now begun in Tokyo.

Going forward, the companies plan to steadily install Toyota’s TransLog data-transmitting driving recorder in more taxis, analyzing visual driving data from these devices to find factors that correlate with taxi demand and then working with the taxi dispatch support system to apply the results of this research.
Expanding Mobility Services in the Near Future

Toyota is analyzing and processing the big data generated by cars to create information that is useful for customers and a variety of connected services. We want the car to be a seamless extension of customers’ phones and computers, a kind of personal assistant on wheels that is able to anticipate their needs using AI.

Based on this concept, we created the e-Palette Concept Vehicle. Using connected and automated driving technologies, the e-Palette will serve as a common mobility platform that meets the needs of a wide range of service providers and business applications, including car-sharing, ride-sharing, parcel delivery, and retail.

In other words, a single e-Palette Concept Vehicle could, depending on the time or other conditions, be used for a range of purposes by different operators. This is the vision of mobility service that the e-Palette makes possible.

Furthermore, vehicle information constantly gathered through the MSPF will help optimize maintenance as well as the collection of data that can be used to anticipate demand for goods and services. Based on such capabilities, we are aiming to achieve the ultimate in just-in-time service, in which, when a customer summons an e-Palette Concept Vehicle, not only does it set out immediately, but it is already nearby.

Creating Automated Driving Mobility Services

In August 2018, Toyota and Uber announced an agreement to expand their collaboration with the principal aim of advancing the development of and bringing to market ride-sharing services leveraging automated driving technologies. To this end, Toyota’s Sienna Minivan will be modified to create the initial fleet of dedicated “Autono-MaaS” (autonomous mobility as a service) vehicles. These Autono-MaaS vehicles will be constantly connected to the MSPF and equipped with both Uber’s autonomous driving system and the Toyota Guardian automated safety support system. By using both systems together, we aim to better monitor vehicle surroundings in real time to realize even safer, more reliable automated driving mobility services. Deployments of these vehicles on the Uber ride-sharing network will begin in 2021.

In October 2018, Toyota and SoftBank Corp. agreed to form a strategic partnership to facilitate the creation of new mobility services. The two companies plan to establish a joint venture company, MONET Technologies Corporation, before the end of fiscal 2019. MONET will provide coordination between Toyota’s MSPF and SoftBank’s IoT Platform. By utilizing a wide range of data related to the movement of people and vehicles, MONET will seek to optimally balance supply and demand in transportation and launch new MaaS businesses capable of resolving mobility-related social issues and creating new value. Through MONET, we plan to roll out Autono-MaaS businesses based on e-Palette by the mid-2020s.

Toyota is accelerating initiatives as a mobility service platform provider, aiming to create a smart mobility society that offers freedom of movement, safety, and excitement for all.
Strengthening Our Competitiveness to Deliver Ever-Better Mobility to Customers around the World

Toyota believes that the true value of mobility is the freedom it enables. No matter how times change, Toyota’s love of cars will never fade. At the same time, our passion for mobility is not limited to cars. Technologies for making transport easier, more convenient, and more enjoyable for people around the world are evolving, and the value that Toyota provides is expanding on numerous fronts. This is why Toyota announced its intention to transform into a mobility company.

As Toyota works to reinforce its efforts related to a wide range of mobility services, its approach of seeking to be the “best in town” will be essential. When creating new services, the business environment, particular challenges, and distributors in each region vary greatly. Toyota must provide cars and mobility services that are closely tailored to customer lifestyles and regional characteristics and make itself an indispensable presence in local communities.

Seeking to be the best in town is an approach that reinforces competitiveness and thereby leads to sustained growth.

In this way, Toyota’s vision is extremely clear. To achieve this vision with emphasis on speed and openness, Toyota is working to reform businesses throughout the Group—and sometimes extending beyond the Group—based on a “home and away” perspective. “Home” refers to operations and regions in which we can add value ourselves through Genbutsu (on-site, hands-on experience) and in which we have competitive advantages over our rivals.

“Away,” meanwhile, refers to operations and regions in which we will work with other companies that have more advantages than we do in terms of expertise. By reexamining our businesses and effectively allocating management resources to “home” and “away” companies, we can increase productivity and make the entire Toyota Group more competitive.

And, above all, Toyota believes that applying Genbutsu in their work at more specialized companies will help our human resources grow and develop.

Furthermore, under the “home and away” approach, we will transcend the borders of the Group’s operations. By developing working relationships with other companies which have same aspirations with us, we can make an enormous impact in this time of immense change.

If it’s not fun, it’s not a car. As the value consumers seek in cars diversifies, Toyota will continue to listen carefully to its customers, reinforce its competitiveness, and deliver ever-better mobility to even more customers.

Shifting to a Region-based Approach in Japan, Toyota’s Home Market

Conditions in Japan’s automotive market are expected to become more difficult than ever. The market is contracting as a result of such social issues as the declining and graying population, urbanization, and rural depopulation. At the same time, the market is changing, with increased use of IT, AI, automated driving, and other technological innovations, as well as the emergence of new rivals.

To adapt to future market changes, Toyota launched in 2016 the J-ReBORN Plan under which it has been working to transform the domestic car sales business.

Until now, Toyota’s growth in the Japanese market has been based on sales efforts that were focused on channels and uniformly implemented nationwide. Toyota’s love of cars will never fade. At the same time, our passion for mobility is not limited to cars. Technologies for making transport easier, more convenient, and more enjoyable for people around the world are evolving, and the value that Toyota provides is expanding on numerous fronts. This is why Toyota announced its intention to transform into a mobility company.

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Until now, Toyota’s growth in the Japanese market has been based on sales efforts that were focused on channels and uniformly implemented nationwide. Toyota, in particular, is the earliest adopter of mobility service, seeing a shift from car ownership to car usage. Targeting the Tokyo region, we plan to integrate Tokyo Motor Motor Co., Ltd., Tokyo Toyopet Motor Sales Co., Ltd., Toyota Tokyo Corolla Co., Ltd., and Netz Toyota Tokyo Co., Ltd., to form a new company in 2019. By efficiently developing its dealer network and by concentrating its resources, Toyota will continue working to be the best in town.

Changes in Japan’s Market Environment
- Declining, graying population
- Urbanization, rural depopulation
- Further market contraction

Changes in the Automotive Business
- Increased use of IT, AI, automated driving, and other technological innovations
- Emergence of new rivals
- Expansion of car sharing (non-ownership)

The speed of market change is an order of magnitude greater than ever before

J-ReBORN Plan

With an urgency unmatched since our founding, we are pushing forward ambitiously alongside dealers to truly thrive in this period of immense change, for the sake of our future customers’ peace of mind and for the sake of our sustainable future.
Strengthening Our Competitiveness to Deliver Ever-Better Mobility to Customers around the World

Reinforcing Group Competitiveness—Collaboration with Toyota Tsusho

Beginning with the export of the Land Cruiser and other models to Africa in the 1950s, Toyota has worked closely with customers in sub-Saharan countries and throughout the continent. Today, Toyota South Africa Motors (Pty) Ltd., serves as a manufacturing and export base and boasts South Africa’s highest vehicle production volume.

Africa is sometimes called the “last frontier”—as this appellation suggests, it is a market with enormous potential. Toyota Group company Toyota Tsusho Corporation (TTC) has significant business strength on the continent, with a dedicated Africa Division and over 10,000 Group employees in the region.

Toyota is now advancing preparations to transfer all of its sales and marketing operations in African markets to TTC in January 2019. This move embodies our aspiration to be the best in town in the region by concentrating operations at TTC, a Group company that has a “home” in Africa.

To facilitate greater coordination, Toyota has selected a former TTC executive who has a wealth of experience in local operations as its CEO of Africa region. By reinforcing human resource development at both companies, we will further accelerate businesses in Africa.

Learning from the “Let’s Do It” Spirit—Collaboration with Suzuki

Toyota has learned a great deal over the years through open collaboration with competing manufacturers. Our partnership with Suzuki is one such effort. While Toyota has built strong business foundations in Southeast Asia, it has yet to effectively exercise its strength in other emerging nations, such as India, where Suzuki has utilized its famous “Let’s Do It” spirit to the fullest and built a solid position.

In February 2017, Toyota and Suzuki concluded a memorandum regarding a business partnership. Moving toward concrete collaboration, in November 2017, the two companies agreed to discuss setting up a cooperative structure for introducing electric vehicles in the Indian market around 2020. Then, in March 2018, Toyota and Suzuki concluded a basic agreement to supply one another with hybrid and other vehicles, with the aim of bolstering both companies’ product lineups and encouraging competition in the Indian automotive market. In May 2018, we agreed to begin discussions related to three joint projects in such areas as car production and powertrain development assistance.

Toyota will continue to learn from Suzuki’s “Let’s Do It” spirit, working as a member of Indian industry to realize a freer, more enjoyable future mobility society. Together, we are advancing toward a day when “Made in India” cars will be widely loved not only in India, but also in Africa and other regions around the world.

The “One Toyota” Initiative, Focused on Sustainable Growth—From Visitor to Neighbor

In April 2014, Toyota announced the “One Toyota” initiative aimed at consolidating its regional head office functions in North America. The July 2017 grand opening of Toyota’s new North American headquarters in Plano, Texas, was the first new opening under the initiative. Previously, Toyota’s North American functions were in four locations—California, Kentucky, Michigan, and New York. Now, the sales management, financial services, external relations, public relations, and research functions have been consolidated in Plano, while purchasing and production engineering have been consolidated at a Technical Center in Ann Arbor, Michigan, and a Production Engineering and Manufacturing Center in Georgetown, Kentucky, respectively. By strengthening cross-functional coordination, Toyota has created a framework for responding to the needs of North American customers faster in order to make ever-better cars that exceed expectations.

Toyota began operations in the United States 61 years ago, in October 1957, with just a single dealer. Today, Toyota’s businesses are deeply rooted in the United States socially, economically, and culturally; Toyota’s direct investments in the country to date total approximately US$25 billion; and the Company operates 10 manufacturing assembly facilities, boasts almost 1,500 dealers, and employs approximately 137,000 people nationwide (including direct and indirect workers and dealer employees).

The new North American headquarters in Plano sends the clear message that Toyota is here to stay and contribute to the community.

With the opening of the new headquarters, approximately 3,000 employees have relocated from the four previous sites, and Toyota has made about 1,000 new hires. Toyota has also committed to investing approximately US$10 billion in the United States over five years. These funds are being put toward such endeavors as the construction of the new headquarters and reinforcing the competitiveness of existing plants.

Going forward, Toyota will continue to step up its competitive strength as “One Toyota” in North America and contribute as a neighbor, aiming to be the best in town.
Eliminating CO\textsubscript{2} Emissions from New Vehicles by 2050: Popularizing Electrified Vehicles

In December 2017, Toyota announced its plans to sell more than 5.5 million electrified vehicles per year globally by 2030. As part of the Toyota Environmental Challenge 2050, launched in 2015 to contribute to the realization of a sustainable society, we set for ourselves the New Vehicle Zero CO\textsubscript{2} Emissions Challenge, under which we aim to reduce Toyota’s global average new vehicle CO\textsubscript{2} emissions in 2050 by 90% compared with the 2010 level. This new initiative to popularize electrified vehicles is one of our medium- to long-term measures to achieve this target.

Toyota believes that eco-friendly vehicles can best help protect the environment if they are in widespread use. To consistently provide products that meet customer expectations and needs as a mass manufacturer, a diverse lineup of electrified vehicles is essential. At the same time, Toyota is advancing initiatives on all fronts, including technological innovation as well as social infrastructure development tailored to the energy and usage conditions of specific countries and regions.

Toyota regards the current once-in-a-century transformation of the automobile industry—including the promotion of electrification—as an unparalleled opportunity to deliver new value to customers and expand its business.

A New Push to Popularize Electrified Vehicles by 2030

Toyota aims to sustainably grow while steadily solidifying its business base through the three values of excitement (excitement that wows you), and environmental sustainability. By doing so, we hope to contribute to the creation of a sustainable mobility society and bring smiles to our customers’ faces.

Electrification will be indispensable to reducing vehicle CO\textsubscript{2} emissions and thus addressing global warming, a challenge facing the entire planet. Toyota is steadily advancing efforts in this area under the Toyota Environmental Challenge 2050 established in October 2015.

In particular, to popularize electrified vehicles, Toyota is aiming for at least 50% of all the vehicles it sells globally in 2030 to be electrified, and, of those, for more than 10% to be battery electric vehicles (BEVs) or fuel cell electric vehicles (FCEVs). To this end, we have set the following three intermediary targets. First, from 2020 onward, we will advance the full-scale roll-out of BEVs. Specifically, we will launch mass-market BEVs developed by Toyota for the Chinese market in 2020, then expand sales to Japan, India, the United States, Europe, and around the globe. We plan to introduce more than 10 BEV models in the first half of the decade.

Next, while expanding our lineup of dedicated electrified models, such as the Prius and Mirai, we will make electrified versions available for other models, as well, aiming to have no models lacking an electrified option by around 2025.

Basing calculations on our current global sales, by 2030 we aim for annual sales of more than 5.5 million electrified vehicles, including hybrid electric vehicles (HEVs), plug-in hybrid vehicles (PHEVs), BEVs, and FCEVs. Of this total, we are aiming for more than 1 million to be BEVs, FCEVs, or other zero-emission vehicles.

In the 20 years since launching the Prius in 1997, Toyota has sold more than 12 million electrified vehicles around the world, helping to cut CO\textsubscript{2} emissions by more than 94 million tons.* Today, Toyota offers 36 electrified models in more than 90 countries and regions, maintains an electrified vehicle development staff numbering 4,500 within the Company alone, and sells more than 1.5 million of these vehicles each year. These figures are a testament to the trust that customers have in these vehicles’ quality, durability, and reliability; customer support for this type of vehicle over the years; the vast technological expertise built up by the Group; and Toyota’s successful establishment of electrified vehicle mass production technologies in Japan and around the world. The electrified vehicle technologies and expertise it has

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<tr>
<th>Toyota’s Major Recent Initiatives in Electrification</th>
<th>Vehicle Electrification Milestones</th>
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<tbody>
<tr>
<td><strong>June 2018</strong> Announced a joint next-generation convenience store project with Seven-Eleven Japan to begin in autumn 2019, aimed at greatly reducing CO\textsubscript{2} emissions.</td>
<td><strong>2020</strong> Electrified vehicles &gt;50% BEV/FCEVs &gt;10%</td>
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<td><strong>May 2018</strong> Move to expand fuel cell stacks and high-pressure hydrogen tank production equipment, aiming to increase sales of FCEVs from around 2020.</td>
<td><strong>2030</strong> Zero CO\textsubscript{2} Emissions Challenge</td>
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<tr>
<td><strong>April 2018</strong> Launched the first Aichi Low-carbon Hydrogen Supply Chain project, aimed at establishing a hydrogen-powered society in cooperation with the Aichi prefectural government, local companies, municipal authorities and other partners.</td>
<td><strong>2014</strong> FCEVs</td>
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<td><strong>February 2018</strong> Announced that sales of electrified vehicles in 2017 reached an all-time high, surpassing 1.52 million and achieving one of the Toyota Environmental Challenge 2050 targets three years early.</td>
<td><strong>1997</strong> Worldwide first mass-production HEV</td>
</tr>
<tr>
<td><strong>January 2018</strong> Presented the e-Palette Concept Vehicle, a BEV for mobility services, at CES</td>
<td><strong>2020</strong> Start of full-scale BEV rollout</td>
</tr>
<tr>
<td><strong>December 2017</strong> Announced an initiative to popularize electrified vehicles from 2020 to 2030.</td>
<td><strong>Around 2025</strong> Electrified versions available for all models</td>
</tr>
<tr>
<td><strong>December 2017</strong> Began a feasibility study with Panasonic Corporation of a joint automotive prismatic battery business.</td>
<td><strong>1990</strong> HEV <strong>2000</strong> PHEVs <strong>2010</strong> FCEVs <strong>2020</strong> BEVs</td>
</tr>
<tr>
<td><strong>September 2017</strong> Established EV C.A. Spirit Corporation with Mazda and DENSO to jointly develop technologies for electric vehicles.</td>
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* Orsco Co., Ltd., an independent organization that monitors CO\textsubscript{2} emissions.
Eliminating CO₂ Emissions from New Vehicles by 2050: Popularizing Electrified Vehicles

accumulated over the decades are a vital strength of Toyota and will provide a solid foundation for the popularization of electrified vehicles going forward.

* As of April 30, 2018

Comprehensive Initiatives Related to Products, Technologies, and Social Infrastructure

For Toyota to continue to meet diverse customer needs, it will need to implement robust initiatives covering products, technologies, and social infrastructure. In terms of products, as society undergoes major changes and the needs of customers and markets rapidly diversify, applying technologies in ways that break with convention to diversify our electrified vehicles will be key to their popularization.

For example, in BEVs, in addition to mini-, mid-size, and full-size vehicles, we will expand to buses and trucks and work as a Group to create products for a wide range of applications, including commercial and sharing services.

As for FCEVs, we will expand our lineups of passenger and commercial vehicles in the 2020s. Furthermore, working with Group companies, we will develop applications for our fuel cell technologies in a range of industrial fields.

In particular, a key factor in the popularization of electrified vehicles is batteries. For example, the batteries used in BEVs currently on the market already have capacities several tens of times as large as those used in HEVs, yet that capacity needs to be significantly improved if their cruising range is to be on par with that of HEVs.

To address this difficulty, in December 2017, Toyota began a feasibility study with Panasonic Corporation of a joint automotive prismatic battery business. Furthermore, Toyota is developing solid-state batteries, aiming to commercialize the technology by the early 2020s. Compared with conventional batteries, solid-state batteries are expected to be smaller and safer while achieving dramatically improved performance.

To realize the improvements in performance, cost, and supply capacity necessary to meet its targets for 2030, Toyota will invest approximately 1.5 trillion yen, bolstering R&D and capital expenditure related to batteries. By doing so, we will accelerate efforts to transform the electrified vehicle business to sell more than 5.5 million electrified vehicles in 2030.

Finally, looking at social infrastructure, we must approach the electrification of mobility and problems related to resources and energy comprehensively. Without the establishment of systems for recycling and material materials, the ongoing popularization of electrified vehicles runs the risk of driving up rare metal prices and increasing industrial waste. Toyota has for some time been involved in the reuse and recycling of HEV batteries. For example, these batteries are being used in fixed electricity storage systems, helping to realize stable energy circulation at power plants and factories.

From an energy standpoint, Toyota aims to help create a society that utilizes both electricity and hydrogen. We are advancing a variety of initiatives, including pilot projects aimed at utilizing renewable energy and building a low-carbon society. In the long run, we envision a society that is built on diverse energy sources and that effectively utilizes electricity and hydrogen. To achieve this vision, we are working with the entire Group as well as outside corporate, government, and other partners to help develop a sustainable mobility society.

Toyota is currently the electrified vehicle market leader; approximately one in two such vehicles sold around the world is a Toyota. Going forward, Toyota will seek to maintain this lead by advancing initiatives related to products and the technologies and social infrastructure that support them. Through these initiatives to popularize electrified vehicles, together with initiatives related to connected technologies and automated driving leveraging AI, we will continue to ambitiously strive toward the realization of the mobility society of the future.

Core Technologies Shared Across Electrified Vehicles

Diversified Electrified Vehicles

Toyota’s Battery Development
Eliminating CO₂ Emissions from New Vehicles by 2050: Popularizing Electrified Vehicles

To realize a sustainable society, it will be important to effectively use electricity and hydrogen together in order to fully leverage CO₂-free renewable energy sources. Hydrogen allows for the storage and efficient use of electricity derived from fluctuating natural energy sources. Furthermore, hydrogen can be used as a direct energy source in FCEVs and industrial applications. While hydrogen will thus be highly useful going forward, realizing a hydrogen-powered society will require a great deal of time and investment. In addition, cooperation with a diverse range of stakeholders will be indispensable. Toyota performs a leading role in the Hydrogen Council, a global initiative promoting a united vision and long-term goals for the transition to new energy using hydrogen, as well as Japan H₂ Mobility, LLC, which aims to develop a network of hydrogen stations across Japan. Through these and other efforts, we are proactively contributing to the creation of a hydrogen-powered society.

Energy Use in a Sustainable Mobility Society

Using electricity and hydrogen for a society built on diversified energy

90% of Toyota Vehicles Sold in 2030 Will Have Conventional Engines

Innovating Powertrains to Enhance both Driving and Environmental Performance

Toyota’s environmental technology strategy is based on the three pillars of saving energy, using diverse fuels, and the understanding that eco-friendly vehicles can best help protect the environment if they are in widespread use. We expect that 90% of the vehicles we sell in 2030 will have conventional engines (as gasoline-powered vehicles, HEVs or PHEVs). As such, to reduce CO₂ emissions, the continued improvement of powertrain fuel economy is vital.

Accordingly, Toyota is working to achieve both excellent driving performance and excellent environmental performance by remaking and significantly evolving its engines, transmissions, and hybrid technology through Toyota New Global Architecture (TNGA), its program of structural innovation aimed at making ever-better cars. Through development under TNGA, we are thoroughly examining all aspects of basic performance for opportunities for improvement, including making components lighter and more compact, creating vehicles with lower centers of gravity, utilizing high-speed combustion in engines, and employing more gears to make transmissions more efficient.

Toyota will continue to use TNGA-based modular development to rapidly bring these powertrains to numerous models. We plan to introduce these new powertrains in 37 variations of 19 models by 2021.* Plans call for expanding sales of such vehicles to approximately 80% of all new vehicles sold in 2023 on a non-consolidated basis (in Japan, the United States, Europe and China). We estimate that the increased fuel economy of the new TNGA powertrains alone will reduce the CO₂ emissions from the cars sold by Toyota on a non-consolidated basis in 2023 by at least 18%.

* Variations include FF vs. FR layouts, passenger vs. commercial applications, conventional vs. hybrid vehicles, and differences in torque capacity.
Making Ever-better Cars: Continuing to Make Cars That Will Be Beloved

The automotive industry is in the midst of a period of profound change. For Toyota to continue to grow going forward, it must, above all, make its cars even more appealing and continue to deliver cars that will enhance users’ lives and be beloved by customers. As information, intelligence, and electrification technologies develop, the nature of mobility will surely change, but Toyota will remain committed to ensuring that its cars will be beloved as it makes ever-better cars that are more convenient, safer, and more eco-friendly.

To this end, we are implementing structural innovation across our global car making business. Namely, we have launched Toyota New Global Architecture (TNGA), under which we are changing our cars from the basic architecture outward to greatly enhance basic performance and product appeal. Building on this foundation, we have also adopted a product-based in-house company system aimed at creating even more distinctive finished cars. We will continue to reinforce both TNGA and the product-based in-house company system, aiming to more quickly respond to customer demand.

Since its founding, Toyota has made cars in line with its Customer First policy. Through these efforts, it has developed unique methods and values, such as the Toyota Production System (TPS) and Kaizen, which have been passed down as wellsprings of competitive strength. By actively applying these strengths at development and production preparation sites going forward, we will endeavor to make ever-better cars that surpass customer expectations.

TNGA So Far

TNGA is a program of structural innovation aimed at making ever-better cars, starting by changing their basic architecture. Through TNGA, we are completely remaking the basic frames of our cars while dramatically enhancing design to catch our customers’ eyes and capture their hearts and improving basic performance to provide a driving experience that customers will want to never end. At the same time, we are advancing total optimization by pursuing smart sharing, thereby improving efficiency and reducing costs. These efforts are greatly increasing our potential to create cars that will be beloved by customers.

Building on the foundation provided by TNGA, the in-house companies consider each region’s market needs and consumer preferences to craft distinctive, appealing cars that customers will love.

Toyota began its TNGA initiatives with the development of the fourth-generation Prius (launched in Japan in December 2015) and then applied them to create two other mid-size models, the C-HR and Prius PHV. We next applied TNGA to full-sized models, announcing the Camry and the Lexus LC and LS in 2017 and the Crown and Corolla Sport in 2018. While these cars share TNGA components, the character of each is completely distinct, as is immediately apparent in terms of design and ride. The in-house companies have created these distinctive cars to suit different customer preferences, so that every customer can find a car they will love. Going forward, we will expand TNGA to compact-class cars, as well, to serve even more customers.

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Making Ever-better Cars: Continuing to Make Cars That Will Be Beloved

Until now, we have developed such different cars separately. By implementing TNGA across the Company, however, we are able to more quickly introduce new models. And, by reinvesting the resources saved through these initiatives in further enhancing quality and product appeal, we are accelerating a virtuous cycle that enables us to deliver ever-better cars even faster.

The Next Evolution of Making Ever-better Cars

While we have thus made progress, certain areas that still need work have also come to our attention. As a result of our focus on improving performance and product appeal, we have heard from some customers that, while they can tell that our cars have and product appeal, we have heard from some customers that, while they can tell that our cars have ever-better cars even faster.

As a model project, we have created a team consisting mainly of young employees from design and performance evaluation and production preparation units, which develop vehicles, to implement the TPS approach. Each day, the team members meet to identify overburden and waste in the day’s work, come up with ideas for improvement, and immediately put these ideas into action. This initiative has only just begun, but already the team members more deeply understand one another’s work, have identified redundancies and other waste in the operations of their units, and are working as one to find opportunities for improvement.

I think that introducing the TPS in development units will not only help shorten development lead times and reduce costs, but will also contribute greatly to human resource development. We will use these initiatives to help make ever-better cars that will be beloved by customers.

Making Ever-better Cars That Will Be Beloved

What Customers Love about Cars

Planning and development in line with customer needs and regional characteristics
Balance of product appeal, specifications, and price
Cars that will be beloved by each individual customer

Making Ever-better Cars

Planning
Development
Production preparation
Production
Customers
Logistics
Suppliers

Application of the TPS

New initiatives
Existing initiatives

Introducing the TPS principles
Identifying and eliminating waste

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TOYOTA Annual Report 2018
### Developing Our People and Our Cars: GAZOO Racing

“...In an ideal world, machines would work just as we intend them to. But when we actually try to run them, unforeseen results frequently prove our human reasoning exceedingly shallow. And there is no better way to test our cars and discover how to improve them than auto racing. Just as Olympic athletes give every last drop of effort to test their strength, in racing, automobiles are pushed to the limit—a point that is contested through progressive improvements and lights up the hearts of motor racing fans.”

Through motor sports, Toyota aims to bring excitement and joy to customers, fans, and communities around the world. Above all, developing our people and our cars in order to make and deliver ever-better cars is the unwavering core of Toyota motor sports.

**Motor Sports: In Our Roots**

The above passage comes from the final work of Toyota founder Kiichiro Toyoda, “Auto Racing and the Japanese Automobile Industry,” written shortly before his death.

The demanding environment of competition will drive the development of our people and cars—carrying on this belief, Toyota competes in a number of types of auto racing.

In April 2017, ten years after our first foray into the Nürburgring 24 Hours race, we established GAZOO Racing Company, creating a stronger framework for an ongoing motor sports business and marking the start of a new chapter.

**The Road Builds the People, and the People Build the Cars**

One of the major competitions in which Toyota participates is the FIA World Endurance Championship (WEC), comprising the 24 Hours of Le Mans and other endurance races around the world.

Toyota also competes in the WRC (World Rally Championship), the global motorsport competition, which requires a high level of skill in a variety of conditions. Toyota's WRC team has won titles and accolades in the past, and continues to push for success.

Toyota also competes in the FIA World Endurance Championship (WEC), comprising the 24 Hours of Le Mans and other endurance races around the world. Toyota first entered the 24 Hours of Le Mans in 1985 and took its first win in 2018, 20th the time competing. Toyota's two cars started the race at the very front of the pack and held the top two positions all the way to the end. This marks the first time that a Japanese driver in a Japanese car has won Le Mans.

In 2016, the Toyota team suffered a mechanical failure just three minutes before the end of the race. In 2017, they finished just 8th overall. Going into 2018, they completely revamped their approach. The development goal was changed from optimal lap time to ensuring that the car could get back to the pit no matter what problems arose—in other words, to survive no matter what. The team created a list of likely problems, and then made them happen on test courses, practicing recovering using the car's remaining functions over and over. Doing so enabled the drivers, mechanics and engineers to push further than ever before and gave rise to Kaizen (improvement) based on Genchi Genbutsu (onsite, hands-on experience).

Lastly, Toyota also competes in the 24 Hours of Nürburgring endurance race. This race takes place on the Nürburgring, one of the world’s most difficult courses. Laid out to resemble ordinary European country roads, the Nürburgring has an exceptionally long circuit of 25 km, narrow track widths, a maximum altitude difference of around 300 m, and more than 170 corners. Toyota's team in this 24-hour endurance race comprises mainly mechanics and engineers who are regular Toyota employees. In 2014, all three of Toyota's cars in the race won “best-in-class” awards, including that for the SP-PRO class. The Lexus LFA, in which president Toyoda was a driver, finished 13th overall, taking the top position in the SP8 class.

One of Toyota’s new endeavors is the GR Super Sport Concept. Under this concept, Toyota is using mostly the same main parts and development methods as those employed for the race cars that it competes with in the WEC and applying technologies honed through racing to create a next-generation sports car.

Because race cars are expensive, advancing development without making prototypes is fundamentally impossible. We therefore mainly use model-based development, in which the entire car is considered and simulations are run to determine how each function should run to achieve the desired performance. This approach enhances performance in less time and with fewer people even before prototypes are built.

Within the finely subdivided organizational structure for mass-market car development, which is optimized for efficiency, this kind of approach—looking at the entire car to optimize each function in concert with all the others—is difficult to apply. Using model-based development, Toyota aims to further accelerate efforts to make ever-better cars.

President Toyoda (left), the late master driver Hiromu Naruse

“I don’t want to be preached to about cars by someone who doesn’t even know the basics of driving. We test drivers put our lives on the line to make better cars. You’ve got to understand that.” This frank remark in 2002 was the start of a teacher-pupil relationship between the late master driver Hiromu Naruse and Akio Toyoda. Wanting to be able to correctly judge cars, Toyoda joined Naruse’s team and commenced training. In 2007, at Naruse’s suggestion, Toyoda decided to enter the 24 Hours of Nürburgring endurance race. GAZOO Racing, made up of Toyota employees, competed for the first time that year. It was there that Toyoda, then an executive vice president, first used the pseudonym Morizo to compete as a driver.

As Naruse said, “There is no better way to pass on skills and develop people than racing. What’s important isn’t discussing automaking with words and data, but getting in the actual car, touching it, and discussing with the hands and eyes.” To put this sentiment into action, Toyota uses modified versions of its production cars in the 24 Hours of Nürburgring endurance race. By understanding the strengths and the areas that need improvement of the base cars, then making them into vehicles that are reliable even in the most extreme driving conditions, we aim to learn precisely what it is that makes a car good. This know-how is then utilized in the GR sports car series.
Steady Progress toward Automated Driving

Toyota's ultimate goal in developing automated driving technologies is not simply to create autonomy for cars, but to create a world in which mobility is safe, convenient, enjoyable, and available to everyone. Safety is our topmost priority as we pursue this goal. We believe that we can enhance safety by building partnerships between drivers and their cars.

Even in a future where some driving is automated, we believe that cars will continue to be loved. Toyota believes that safe and fun automated driving technologies have the potential to expand freedom of movement for all and bring cars and people even closer together.

**Toyota’s Unique Approach to Automated Driving**

Since the 1990s, Toyota has engaged in automated driving technology research and development aimed at contributing to the complete elimination of traffic casualties. Today, Toyota is advancing development in this area based on its Mobility Teammate Concept. This concept is an expression of Toyota’s unique approach to automated driving and is built on the belief that people and vehicles can work together in the service of safe, convenient, and efficient mobility.

As implied by the word “teammate,” the inclusion of people is central to this approach, based on our belief that people should have choices. The true value of automated driving technologies, we believe, lies not in the technology itself, but in the social value it creates—helping to create a rich mobility society in which everyone can enjoy safe, convenient, and enjoyable transportation.

Moreover, we believe that the most important factor in the development of automated driving is safety. This conviction is in line with our long-held stance of prioritizing the improvement of safety with the ultimate goal of eliminating casualties from traffic accidents.

Achieving this goal will require the development of safe driving systems that are highly effective in real-life situations as quickly as possible and the promotion of their uptake as widely as possible. To do this, Toyota is promoting, in parallel, the development of advanced safety technologies and the utilization of insights gained through such development to further develop popularized technologies. We have already put our active safety technologies on the market, packaged as Toyota Safety Sense and Lexus Safety System+. Such packages are now offered as standard or optional features on almost all new Toyota and Lexus models sold in Japan, Europe, and the United States. Furthermore, with the new Lexus LS, the brand flagship, we have introduced the Lexus Safety System + A, which includes such new features as Active Steering Assist, a world-first technology, and Front Cross Traffic Alert (FCTA), which helps prevent collisions at intersections. In systems for the non-luxury market, as well, we have introduced the second-generation Toyota Safety Sense, featuring expanded hazard detection for a broadened scope of protection against severe accidents.

**Toyota’s Specific Approaches to Automated Driving**

Under the Mobility Teammate Concept, Toyota is developing automated driving systems based on two approaches: Guardian and Chauffeur.

The Guardian approach assumes that a human will drive the car, while automated driving systems operating alongside the driver provide support, such as added braking, acceleration and steering, when needed, for example, when the car is in danger of collision, to protect the car’s passengers and people outside the car. Chauffeur refers to automated driving as defined by the U.S. non-profit SAE International, where the autonomy drives for extended period of time instead of the human driver.

The Mobility Teammate Concept offers the freedom of choice by allowing users to enjoy the benefits of automated driving technologies while still allowing them to drive safely, enjoyably and freely when they wish. Drivers will be able to choose Chauffeur mode for some situations, such as expressway and long-distance travel. Guardian mode will always attempt to protect people both inside and outside the car, whether the human or the automated Chauffeur is driving.
Developing Automated Driving Technologies on Two Complementary Fronts

Toyota is advancing the development of automated driving technologies on two fronts: personally owned vehicles (POVs) and Mobility as a Service (MaaS).

By offering affordable, on-demand mobility, MaaS will provide platforms that facilitate the road transport of more people around the world—for example, people with disabilities, people who cannot afford to, or prefer not to, own a car—as well as the logistics and commerce that are deeply embedded in, and fundamental to, everyday life. These on-demand mobility services will transform cities, helping to invigorate economies and make society more efficient. To expand such possibilities of mobility, Toyota has unveiled e-Palette, a concept vehicle envisioned for the 2030s that is fully electric and specifically designed for MaaS applications.

MaaS platforms will also produce the vast amounts of data essential to automated driving technologies, helping us achieve the important benefits of automated driving faster than personal car ownership alone.

In terms of evolving POVs, in January 2018, Toyota Research Institute, Inc. (TRI) unveiled its next-generation automated driving research vehicle, Platform 3.0. Built on the Lexus LS 600hL, Platform 3.0 uses a LiDAR* system made by U.S.-based Luminar Technologies to “see” 200 meters in all directions, making it one of the most perceptive automated driving research vehicles on the road. On top of being highly functional, the vehicle’s cameras and other sensors are arranged in a compact package styled to harmonize with the design of the Lexus LS. The integrated packaging of the automated driving equipment also makes it easy to reproduce and adapt in order to build a fleet at scale.

* LiDAR: Short for light detection and ranging. Technologies or devices that use lasers to gather 3D information about the surrounding environment.

Approach to Developing Automated Driving Technologies

Intelligence in Driving: The Potential of Deep Learning in Recognition Technology

Realizing automated driving will require three types of intelligence. The first is driving intelligence, entailing technologies to accurately understand the vehicle’s position and find safe routes. The second is connected intelligence technology to transmit vast volumes of data about constantly changing road and traffic conditions to and from cars. The last is interactive intelligence, based on Toyota’s belief that, in addition to improving the technologies themselves, it is vital to optimize the user interface to maximize automated driving technologies’ usability. TRI is advancing research on all three types of intelligence toward the creation of systems that enable people and cars to work together.

Achieving fully autonomous driving will require deep learning using data on the surrounding environment provided by autonomous sensors, such as cameras, RADAR, and LiDAR, to learn how to avoid collisions. Chainer, a neural network platform developed by Preferred Networks, in which Toyota is an investor, will provide one of the necessary deep learning frameworks. Chainer was written using CUDA, a computing platform that runs on graphics processing units (GPUs) developed by the major GPU manufacturer NVIDIA.

To accelerate the development of intelligence software, in March 2018, Toyota established Toyota Research Institute Advanced Development (TRI-AD) in Tokyo. Applying the ideas of the Toyota Production System (TPS) to software development, TRI-AD is creating an integrated software development model spanning research to commercialization. Furthermore, in the advanced development of automated driving technologies, Toyota has invested in ALBERT Inc., aiming to accelerate technological development by reinforcing big data analytic processes.

As for the creation of systems that enable people and cars to work together, we are studying such questions as how to create user interfaces that enable the safe transition from human-controlled to system-controlled driving, actively using simulated experiments to test our ideas. These initiatives reflect TRI’s human-centric approach.

TRI-AD is advancing automated driving research using Highway Teammate research vehicles, which we aim to commercialize by around 2020. These vehicles will enable driver-supervised automated driving on expressways that includes merging onto and exiting expressways, maintaining and changing lanes, and maintaining appropriate distance from other vehicles. Testing of Highway Teammate vehicles for use on Japan’s Metropolitan Expressway and other particularly difficult-to-drive types of expressway is ongoing.

Three Types of Intelligence and Initiatives Aimed at Commercialization

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<th>Transport services (MaaS)</th>
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Steady Progress toward Automated Driving

1,000-member Intelligence Software Development Company Launched

Toyota established Toyota Research Institute-Advanced Development (TRI-AD), a new, Tokyo-based company, to accelerate its advanced development of automated driving technologies. The new company will be funded by Toyota, Aisin Seiki Co., Ltd., and DENSO Corporation, which have concluded a memorandum of understanding to invest a total of more than ¥300 billion in development.

Dr. James Kuffner, former Chief Technology Officer of TRI, will lead TRI-AD as its CEO. The new company is targeting a staff of approximately 1,000 employees, comprising staff sourced from Toyota, TRI, Aisin, and DENSO along with new hires. A next-generation company test model, the company is formulating new ways of doing work and internal rules, including making English its internal business language.

TRI-AD is applying the Toyota Production System (TPS) approach to software development in order to achieve the following key objectives.

1. Create a smooth software pipeline from research to commercialization, leveraging data-handling capabilities.
2. Strengthen coordination with TRI and efficiently link research results to product development.
3. Strengthen collaboration within the Toyota Group in the domains of research and advanced development.
4. Recruit and employ top-level engineers globally while cultivating and coordinating the strong talent within the Toyota Group.

TRI Establishes Corporate Venture Capital Fund

In July 2017, TRI established Toyota AI Ventures (TAIV), a venture capital fund to invest in start-ups. TAIV invests in recently established promising startups in the fields of artificial intelligence, data and cloud technology, autonomous mobility, and robotics. In just its first year, TAIV invested in 11 start-ups in the United States, the United Kingdom, and Israel.

In July 2018, TAIV unveiled a “call for innovation” program to support startups in partnership with TRI. This program is designed to spur entrepreneurial innovation by identifying key technology gaps and putting out a call for solutions from startups. Promising startups in the areas of the identified gaps will have the opportunity to secure from $500,000 to $2,000,000 in venture capital funding from TAIV as well as the possibility of partnering on a proof of concept project with TRI.

Going forward, TAIV will boldly take on difficult challenges, expanding collaboration with and support for highly motivated entrepreneurs.

TRI to Open Automated Vehicle Test Facility in Michigan

TRI is building a new automated vehicle test course on a 60-acre site within the existing test course of Michigan Technical Resource Park (MITRP) in Ottawa Lake, Michigan. The new facility will be used to safely replicate demanding “edge case” driving scenarios that are too dangerous to perform on public roads, accelerating the development of Guardian Mode research vehicles. The course will include models of congested urban environments, slick surfaces, entrance and exit ramps, and a four-lane divided highway.

TRI Supporting the Development of Open-Source Automated Driving Simulator

TRI has donated $100,000 to the Computer Vision Center (CVC) at the Universitat Autònoma de Barcelona to promote the development of Car Learning to Act (CARLA), an open source automated driving simulator. CARLA is a simulation platform for use in developing and testing automated driving systems designed to ensure the stability of automated vehicles in myriad situations that are not always testable in the real world. Developed by the CVC, it is open source and hosted on GitHub. CARLA offers a multitude of realistic environmental conditions and is designed to be extended and easily modified to fit specific project needs.

1. Open source: A model of software development in which the source code is made broadly available for use and distribution by third parties.
2. GitHub: A web-based software development platform. Users can upload and publish their work (such as program code or design data), enabling collaborative review with the millions of developers on the platform and project management.

TRI is accelerating robotics research—one of the purposes of its establishment—by actively utilizing experiments run with simulators. Many robots currently in use are controlled using visual information. Toyota is adding force and touch sensors to allow robots to better understand their contact with other objects and more precisely adjust the force they apply. Through this research, we hope to quickly move toward a world where indoor robots assist people in daily life.
Solutions for the Problems Facing a Graying Society: Partner Robots

Since the announcement of its development vision in 2007, Toyota has been applying its technology and know-how developed for industrial robots used in vehicle manufacturing to create partner robots that offer support for everyday living, working to bring these robots to market. So-called service robots for non-industrial use include robots designed to inspect infrastructure or provide emergency response. Toyota, however, is focusing on partner robots that work closely with people to provide support for living. Japan is rapidly graying, and its working-age population is decreasing. Because of these shifts, the burden on the working-age population of supporting the elderly is forecast to balloon to approximately three times the 2000 level by 2050. Toyota aims to use partner robots to instead keep this burden at around the 2000 level by 2050. Toyota aims to use partner robots to instead keep this burden at around the 2000 level by 2050.

Under its vision for partner robot technology, "freedom of mobility for all, and the joy of self-reliance," Toyota is working to bring to market products that can facilitate medical care, nursing, and independent living.

Developing Core Technologies and Advancing Commercialization Based on Real, On-site Needs Gleaned through Ongoing Testing

The Welwalk WW-1000 is designed to aid in the gait training of patients with lower limb paralysis due to stroke or other factors. The robot offers a range of rehabilitation support functions based on motor learning theory, including the ability to adjust the difficulty level of gait training to suit the patient and to provide feedback about the patient's gait characteristics.

From May 2017, we began accepting rental orders for the robot from medical institutions, aiming to rent out 100 units. In September 2017, we began coordinating with companies that have strengths in the medical field to supply the robots to hospitals and other facilities.

The Social Robot Pocobee is designed to delay the onset and progression of dementia and reduce the burden on caregivers, all increasingly important issues in light of the forecast increase in Japan’s number of individuals with dementia. Verification tests of Pocobee have been ongoing since 2016 at the National Center for Geriatrics and Gerontology. Going forward, to help users maintain their health, we will enhance Pocobee’s functions that provide goal-oriented encouragement to users to do more based on their individual abilities.

By having caregivers and robots work together, we hope to safely increase the activity of the elderly and improve their vital functions while helping to alleviate the burden on caregivers.

The HSR can perform such basic tasks as picking up, fetching, and handing over objects and is being developed and tested for use in such areas as maintaining senior independence and health management.

Since 2016, Toyota has provided this robot to universities and other research institutions as a platform in order to foster a development community and accelerate development through open innovation.

The HSR was selected as a standard platform for the RoboCup@Home competition at RoboCup2017 Nagoya Japan, and will be provided as the platform robot for the World Robot Summit 2018 and 2020 Partner Robot Challenge.

In November 2017, Toyota announced the T-HR3 humanoid robot. Controlled remotely by a human operator, the entire body of this robot moves smoothly using Torque Servo technology.

The T-HR3 is a partner robot suited for use in ordinary living environments. Able to perform fine hand and arm movements, walk like a human, and retain its balance using its entire body, the robot is being developed to safely work alongside humans in a range of scenarios, such as the home and medical institutions, in order to provide gentle support for everyday living.

In the future, we hope to expand its applications to include work at disaster sites, construction sites, and even in space.

Commercialization Schedule and Development Status

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<td>Standing personal mobility robot</td>
<td>We are testing the robots at test-ride events in retail facilities and on public roads as we work with the police and government to expand areas where they can be used.</td>
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<td>Balance training assistant robot</td>
<td>The robot is in use at 21 medical institutions across Japan for clinical research. We are incorporating feedback from doctors, physical therapists, and other users as we work to bring the product to market.</td>
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Target areas:
- Senior Life Support, Medical Support
- Independence Support, Welfare Support

Development, Pilot testing, Commercialization
Connectivity, automated driving, and electrification are expanding the possibilities of cars. Toyota works closely with customers to understand their needs and wants, striving to enhance the freedom and fun of Mobility for All.
Toyota’s Business Innovation:
Organizational Framework, the Toyota Group, External Collaboration, and TPS and Cost Reduction

There is Always a Better Way: Revising Our Organizations and Businesses

To further advance the goals of making ever-better cars and human resource development, Toyota has been revising its organizational framework and executive lineup. In terms of organizational framework, Toyota introduced region-based management in 2011, followed by a business unit system in 2013. To place greater priority on our Customer First policy and facilitate quick judgment, quick decisions and quick action based on Genchi Genbutsu (onsite, hands-on experience), in April 2016 we established product-based in-house companies, considerably changing the orientation of our business structure from a focus on functions to a focus on products. In September 2017, we established a new company, EV C.A. Spirit, to advance the development of basic structural technologies for electric vehicles via an EV C.A. Spirit, to advance the development of basic structural technologies for electric vehicles.

Toyota has also been working to appoint diverse human resources to the right positions in its executive lineup, to transform the orientation of our business structure from a focus on functions to a focus on products. In September 2017, we established a new company, EV C.A. Spirit, to advance the development of basic structural technologies for electric vehicles via an EV C.A. Spirit, to advance the development of basic structural technologies for electric vehicles.

Today’s Toyota Group* sells more than 10 million new vehicles per year. While maintaining and developing Toyota’s existing businesses, we must boldly move forward to transform into a mobility company.

Reflected in the Toyota Group’s determination to take on this era of profound transformation, in 2018 Toyota moved up the timing for changing its executive lineup from April to January. To transform the roles and awareness of executives, we revised the position of executives within the Company and, from the perspective of putting the right people in the right places, appointed people with high levels of expertise, regardless of time with the company or age. Going forward, all executives and employees will continue to take on new challenges, acting with the constant awareness that there is always a better way.


Speed and Openness, Home and Away

With the advance of electrification, automation, connectivity, and other technologies, the automotive industry has now entered a new phase of cooperation and competition that is transcending industry lines. At the same time, the global automotive market is expected to see continued expansion, chiefly in emerging nations and regions, such as Africa. In order to bring together the strengths of the whole Group and effectively use resources in this era of profound transformation, we are applying a “home and away” perspective as we rebuild the business structure of the Toyota Group as a whole.

“Home” refers to operations and regions in which we can add value ourselves through Genchi Genbutsu (onsite, hands-on experience) and in which we have competitive advantages over our rivals. “Away,” meanwhile, refers to operations and regions in which we will work with other companies that have more advantages than we do.

Rather than advancing alone, Toyota is bringing together the full strength of the Group. We aim to identify the strengths that make up each company’s “home” turf to increase productivity and thereby reinforce the competitive strength of the Group as a whole.

Our approach to alliances with partners outside the Group is the same. Rather than seeking equity-based business scale expansion, we aim to realize a better mobility society through speedy, open collaboration with partners who share our aspirations.

Returning to Our Fundamentals to Blaze the Trail Forward

Toyota strives to efficiently and quickly produce vehicles of sound quality, one at a time, that fully satisfy customer requirements. Underlying these efforts is the Toyota Production System (TPS). The TPS is based on the two concepts of Jidoka (automation with a human touch) and Just-in-Time. Jidoka entails that when a problem occurs, the equipment stops immediately, preventing the production of defective products. Just-in-Time means that, in each process, only what is needed, when it is needed, and in the amount needed is produced or transported. The complete elimination of waste, achieved by applying these two pillars, improves productivity, ultimately reducing costs.

In this era of profound transformation for the automotive industry, we must anticipate customer needs to provide more personalized mobility services more directly and in real time. In other words, we must create a world in which the services that are needed are provided when needed and as needed. This is precisely the essence of Just-in-Time.

The TPS and its approach to cost reduction are wellspringsof competitive strength and unique advantages for Toyota. Thoroughly honing these strengths will be essential to Toyota’s future survival.

In January 2018, we established the TPS Group with the aims of redoubling TPS efforts outside the manufacturing divisions and enhancing competitive strength and productivity. In June, we placed our logistics division within the TPS Group. We are accelerating Company-wide initiatives that position the TPS as the core of corporate management.

Major Actions to Strengthen the Toyota Group from 2016 to Present

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2018</td>
<td>Toyota and DENSIO reach basic agreement to consolidate their electronic component operations at DENSIO</td>
</tr>
<tr>
<td>May 2018</td>
<td>Toyota and Toyota Tsusho reach basic agreement to consider the transfer of all Toyota’s sales and marketing operations to Toyota Tsusho</td>
</tr>
<tr>
<td>March 2018</td>
<td>Toyota Autoparts Philippines, Inc. is made a subsidiary of Asain to strengthen its competitiveness in the manual transmission business</td>
</tr>
<tr>
<td>September 2018</td>
<td>Toyota Research Institute-Advanced Development, funded by Toyota, Asain, and DENSIO, is established to accelerate the development of automated driving technologies</td>
</tr>
<tr>
<td>December 2018</td>
<td>EV C.A. Spirit Corporation, funded by Mazda, DENSIO, and Toyota, is established to jointly develop technologies for electric vehicles</td>
</tr>
<tr>
<td>January 2016</td>
<td>Toyota makes Daihatsu a wholly owned subsidiary to strengthen small car operations</td>
</tr>
</tbody>
</table>
Developing People: The True Source of Toyota's Competitiveness

The heart and spirit of Toyota’s manufacturing is the Toyota Way, and its method of creating things is the Toyota Production System. Unwaveringly applying these basic tenets in our global operations, we have made prioritizing quality, reducing costs, and improving productivity our mission as we constantly work to mass-produce ever-better cars at lower cost. Toyota’s dedication to developing its people makes attaining these goals possible and is the true source of the Company’s competitiveness. To get through this once-in-a-century period of profound transformation and continue growing, it is imperative that we continually make prioritizing quality, reducing costs, and improving systems by hand until they are reliable and safe. First, human engineers meticulously build each new line component by hand to exacting standards, then, through incremental Kaizen, steadily simplify its operations. Eventually, the value added by the line’s human operators disappears, such that any operator can use the line to produce the same result. Only then is the Jidoka mechanism incorporated into actual production lines. Through the repetition of this process, machinery becomes simpler and less expensive and maintenance becomes less time consuming and costly, enabling the creation of simple, slim, flexible lines that are adaptable to fluctuations in production volume.

The work done by hand in this process is the bedrock of engineering skill. Machines and robots do not think for themselves or evolve on their own. Rather, they evolve as we transfer our skills and craftsmanship to them. As shown in the example of the calligraphy robot, below, before transferring skills to machines or robots, it is essential to first develop them in people.

Craftsmanship is achieved by learning the basic principles of manufacturing through manual work, then applying them on the factory floor to steadily make improvements. Employees continually hone their craftsmanship while striving to weave the insights and techniques that doing so provides into machines to create new technologies and manufacturing methods that, in turn, lead to new insights that improve their skills. This virtuous cycle of improvement in both human skills and technologies is the essence of Toyota’s Jidoka. I think that advancing Jidoka in this way helps to reinforce both our manufacturing competitiveness and human resource development.

Human wisdom and ingenuity is indispensable to delivering ever-better cars to customers. Going forward, we will maintain our thoroughgoing dedication to constantly developing human resources who can think independently and implement Kaizen.
My role as CFO and advisor to the president is to keep watch over Toyota's overall management, maintain daily communication with the president, come up with ways to realize the president's aspirations, priorities, and strategies, and give directions as appropriate.

Sustainably increasing corporate value is the duty of all companies. As a mobility company, Toyota is facing a once-in-a-century period of profound transformation and therefore must advance aggressive forward-looking investment and business model innovation. Given this, I would like to share some of my thoughts on the factors that will be important to maintain and increase corporate value going forward.

### Raising the Value of Our Human Resources

A company's true value lies not in its factories, machinery, or other physical assets, but in the people who use them. One of my favorite sayings is from Shingen Takeda, a prominent 16th century lord and general, and literally translates as “people are the stone walls.” In other words, just as rocks of various shapes and sizes can together form a strong stone wall, developing and effectively deploying human resources with diverse values and expertise is essential to building a strong company.

Management determines the Company’s strategy and explains the hurdles that must be overcome to bring out the best efforts of employees so that everyone at Toyota will work hard and support one another as a team. Employees hone their respective expertise and carry out their responsibilities as professionals. Such daily efforts are the essential elements of increasing corporate value and the foundation that supports Toyota.

### Cost Reduction, the TPS, and Next-generation Investment

Cost reduction and the Toyota Production System (TPS) are Toyota's core strengths and traditions, handed down from our predecessors. However, I think that the true essence has not fully infiltrated Toyota at a more fundamental level.

Examining costs means examining actions. We carefully scrutinize all costs, from each pencil used by each individual all the way up to major projects, using the full extent of our knowledge and abilities to determine which parts of our actions are wasteful so that we can improve them. When I visit Toyota’s worksites and talk with employees, I do my utmost to encourage them each to develop an awareness of costs and a concrete view of the value appropriation for specific things and actions. By implementing such activities globally, we are securing the funds to sustainably invest in electrification, automation, connectivity, and other next-generation technologies and to accelerate investment in partner companies and start-ups.

### Maximizing Group Competitiveness

The Toyota Group has grown by building on the foundation laid by Kiichiro Toyoda and constantly pushing to do better. The strength of the Toyota Group is in its shared set of basic values. As we prepare to take on new rivals in as-yet unknown arenas, it is more important than ever to return to the roots of the Group and gather our full strength. By having each Group company focus on its particular areas of expertise, we will further enhance our competitiveness. To do this, we are rebuilding our existing frameworks. I think that the common values shared by the companies of the Group are what will enable the success of the “home and away” strategy espoused by President Toyoda.

To achieve this strategy, we will reduce consolidated fixed costs, streamline development and investment, reinforce cost competitiveness, and advance human resource development to achieve greater results from the efforts of the Group’s employees and thereby increase the corporate value of the Group as a whole.

Going forward, I will be sure to report the yearly progress and results of such initiatives to our investors and shareholders.
Financial Strategy

Three Pillars

The three pillars of Toyota’s financial strategy are stability, growth, and efficiency. By maintaining adequate stability while pursuing growth and efficiency over the medium and long terms, we aim to build a robust financial foundation to support sustainable growth.

1. Stability: Securing Liquidity
Having experienced financial crises and the Great East Japan Earthquake, in order to ensure business continuity in any business environment, we maintain a sufficient level of liquidity to cover half a year of both fixed costs in the automotive business and refinancing requirements in the financial services business.

Ample liquidity is essential to maintaining a full line-up in each region and retaining the ability to respond to all options and opportunities in this era of profound transformation in mobility. As such, it is a vital part of the foundation supporting the creation of corporate value.

2. Growth: Aggressive Forward-looking Investment
The auto industry is on the verge of a once-in-a-century turning point. We believe that technological innovation in such areas as connected technologies, automated driving, sharing, and electrification will be key to the mobility of the future. Every year, we spend more than 1 trillion yen on R&D. By enhancing efficiency in existing areas, we are strategically increasing the portion of R&D spending allotted to cutting-edge fields like the above.

Furthermore, we are investing in new initiatives. Examples of such investment include the establishment of TRI-AD, which is funded by Toyota, DENSO and Aisin; investment in start-ups through the Mirai Creation Fund and Toyota AI Ventures; and investment in such business partners as Grab, ALBERT, and Uber.

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3. Efficiency: Enhancing Capital Efficiency
Using cost reduction and the thorough application of the TPS, we are reinforcing the profit structure and securing funds to invest in advanced and cutting-edge technologies.

In capital expenditure other than R&D expenses, as well, we are carefully assigning priority to individual projects and tracking their progress while advancing measures to improve productivity, such as streamlining development in existing fields, making equipment more compact, shortening processes, and facilitating faster response to changes in production quantities.

Furthermore, in addition to sustainably increasing ROE by repurchasing shares, we are strengthening investment management by regularly evaluating the rationality of our strategic shareholdings in terms of the needs of our business strategies and economic utility. In these ways, we are striving to enhance capital efficiency.

Shareholder Return

We prioritize shareholder return as part of our capital policy. In principle, shareholder return is determined on the basis of net income.

We strive to maintain stable and sustainable dividend payments based on a benchmark consolidated dividend payout ratio of 30% while considering such factors as our financial results, investment plans, and liquidity. For the fiscal year ended March 31, 2018, we paid an annual dividend of 220 yen per share.

We-flexibly consider the repurchase of shares in light of long-term capital efficiency and changes in our business environment. For the fiscal year ended March 31, 2018, we paid out 549.9 billion yen for the repurchase of shares, resulting in a total of 74 million shares acquired. Combined with dividends, this brought the total annual shareholder return to 1.2 trillion yen, for a consolidated payout ratio of 48.1%.

Going forward, we will strive to further improve net income and ensure ongoing shareholder return through dividends and share repurchases.

Diversifying Our Funding Base

To diversify our means of funding, in 2015 Toyota issued approximately 500 billion yen in Model AA class shares to raise funds for long-term R&D activities and build a base of medium- and long-term shareholders. The funds raised are being invested in R&D related to advanced and cutting-edge technologies, such as fuel cells, infrastructure, information technology, and highly intelligent mobility.

In 2018, we issued 2 billion U.S. dollars in international straight bonds, our first ever such offer overseas. The proceeds are being used as operating capital and for capital expenditure. Through such measures, we are diversifying our funding base to ensure that we can respond on all fronts to new challenges and opportunities in this time of profound transformation in mobility.

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Dividend per Share and Net Income

<table>
<thead>
<tr>
<th>Dividend per Share and Net Income</th>
<th>Interim dividend</th>
<th>Year-end dividend</th>
<th>Net income (right axis)</th>
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<table>
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<tr>
<th>(Yen)</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
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<tbody>
<tr>
<td>(Years ended) ‘19/3</td>
<td>65</td>
<td>50</td>
<td>70</td>
<td>90</td>
<td>100</td>
<td>120</td>
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<tr>
<td>‘10/3</td>
<td>20</td>
<td>30</td>
<td>60</td>
<td>90</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>‘11/3</td>
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<td>90</td>
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<td>30</td>
<td>60</td>
<td>90</td>
<td>100</td>
<td>120</td>
</tr>
</tbody>
</table>

| Total amount of dividends (common shares) (Billions of yen) | 702.9 | 924.6 | 1,287.2 | 1,082.4 |
| Share repurchase for shareholder returns (Billions of yen) | 1,200.1 |

<table>
<thead>
<tr>
<th>Total Shareholder Return and Total Return Ratio</th>
<th>Total amount of dividends (common shares) (Billions of yen)</th>
<th>Share repurchase for shareholder returns (Billions of yen)</th>
<th>Share repurchase to avoid dilution of common shares (Billions of yen)</th>
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</thead>
<tbody>
<tr>
<td>(Years ended)</td>
<td>14/3</td>
<td>15/3</td>
<td>16/3</td>
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<td>Total amount of dividends (common shares) (Billions of yen)</td>
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<td>Share repurchase for shareholder returns (Billions of yen)</td>
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<td>639.3</td>
<td>645.5</td>
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<td>Share repurchase to avoid dilution of common shares (Billions of yen)</td>
<td>349.9</td>
<td>349.9</td>
<td>349.9</td>
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<tr>
<td>Total shareholder return (Billions of yen)</td>
<td>702.9</td>
<td>924.6</td>
<td>1,287.2</td>
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<tr>
<td>Total return ratio*</td>
<td>38.5%</td>
<td>42.5%</td>
<td>55.6%</td>
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</table>

* Payout ratio: This is the ratio of (i) the amount of dividend per common share to (ii) net income attributable to Toyota Motor Corporation per common share.

*2 Total Return Ratio: This is the ratio of (i) the sum of dividends on both common shares and the First Series Model AA Class Shares and the amount of repurchase of common shares for shareholder return to (ii) net income attributable to Toyota Motor Corporation.