#MOBILITY LIFE BALANCE

NEXT GENERATION MOBILITY
€36,518 M

SALES*

€

148 K

EMPLOYEES*

COUNTRIES*

* As of 2019-12-31

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Arrow symbols indicate links to additional content.
ZF is not only making the mobility of tomorrow automated, clean and safe, but also affordable for everyone as well as universally available.

Our employees develop and produce sustainable solutions that are compatible with a wide range of technologies for use in passenger cars, commercial vehicles and off-road machinery.

This allows us to make a fundamental contribution to the continuous development of societies around the world. After all, mobility is a basic human need.
Mobility pledges to provide individual freedom and independence. However, the reality today often does not deliver on this promise.
he car has long been regarded as a symbol of freedom and independence. Advertisements still use the image of happy people that are able to travel to interesting destinations around the world in a relaxed manner thanks to modern automotive technology. Unfortunately, reality paints a completely different picture, as drivers have to contend with traffic jams, stress, the hunt for a parking space, driving bans and accidents as part of their everyday routine. What is more, the consumption of natural resources and emissions give motor cars a negative image. There is no doubt that the promise of mobility and the reality are two totally different things.

Our mobility is coming apart at the seams
As a technology group and a provider of mobility solutions, ZF took this development as an opportunity to launch a major campaign last summer. It’s name? #MobilityLifeBalance. The initiative was promoted not only by the Group’s presence at a wide range of trade fairs and events, but also by means of its own website, by a social media and advertising campaign, as well as by a zeppelin adorned with the relevant branding, circling in the skies above selected events. The aim of #MobilityLifeBalance was, and still is, to openly discuss the negative aspects of current mobility solutions, and also to show how ZF and every single person can help to establish a balance between mobility and life once again.

Ultimately, the desire for mobility is a basic human need among the constantly growing world population. Forecasts by the United Nations indicate that the global population, which currently stands at 7.4 billion, will increase to almost 8.4 billion people in 2035. If no changes are made to the way in which we approach mobility, this population growth will result in more traffic, a greater burden being placed on the environment and rapidly rising mobility costs.
This is not acceptable. Consequently, there is an urgent need for action with respect to the further development of mobility solutions. “Individual mobility is one of the accomplishments that have been responsible for our quality of life improving dramatically over the last few decades,” comments Wolf-Henning Scheider, CEO of ZF. The campaign is based on the ZF Next Generation Mobility corporate strategy. This can be used by all employees as a compass that shows the way forward for all Group activities. Every day, ZF strives to ensure that the mobility of the future will remain accessible and at the same time affordable for everyone, that it is convenient and readily available, that it comes with greater levels of safety and comfort, and that it is even more efficient and sustainable.

**ZF technology for “Next Generation Mobility”**

The launch of the initiative was marked by the ZF Global Technology Days at the start of July 2019. Traditionally, the Group uses this event to inform the assembled representatives of the financial and trade media about the ZF highlights that are to be showcased just a few weeks later at the International Motor Show (IAA). At last year’s driving and product event for international journalists, ZF presented new solutions for next-generation mobility, with those in attendance being given a glimpse of four different passenger car innovation prototypes. These prototypes were equipped with innovative products for hybrid and electric drives, system solutions for automated driving and new features in the fields of integrated security and chassis technology.

**Information portal contains facts and tips**

In parallel to the ZF Global Technology Days, ZF launched a website specifically dedicated to the initiative at www.mobilitylifebalance.com. Visitors to the website who are interested in the initiative will find a wide range of information such as articles, infographics and videos on challenges and possible solutions. The website also features practical tips for anyone interested in improving their personal #MobilityLifeBalance. These range from suggestions on how to combat travel stress to technical checks that are easy to carry out on passenger cars to ensure improved road safety. ZF also promotes a large amount of this content via its own social media channels.

Against the backdrop of the biggest upheaval in the history of the automotive industry, with which companies in this industry and their employees are currently having to contend, the ZF campaign is not only a perfect fit with the slogan of IAA 2019, “Driving tomorrow,” but also has its finger on the pulse of contemporary social trends.
With its initiative, ZF is addressing a topic that is currently important to a large number of people. The evaluation of this campaign makes this clear – and encourages the Group to continue.

This Share of Voice score is excellent and describes our online visibility compared to our competitors. In 2017, which was also a passenger-car IAA year, the figure was 25 percent.

486 m contacts* was the gross reach of the #MobilityLifeBalance initiative.

74 m impressions* thanks to the social media campaign on the ZF channels.

34 % This Share of Voice score is excellent and describes our online visibility compared to our competitors. In 2017, which was also a passenger-car IAA year, the figure was 25 percent.

*In the period from June 1 to December 31, 2019.
OUR PLAN FOR THE MOBILITY OF THE FUTURE

The vehicle industry as we know it is a thing of the past. We need to find new solutions and take advantage of the new opportunities being presented to us.
Mr. Scheider, what do you have to say about how the business has been performing over the last year?

2019 was a difficult year for the automotive industry. The overall economic trend and the challenges arising from the ongoing transformation of the business have brought enormous challenges to the fore. However, opportunities also presented themselves. We took advantage of them as they arose and won important contracts for the future. For example, we were able to attract significant new business in the areas of electromobility, AD/ADAS and conventional technology, with the latter continuing to give us the backing we need to make investments.

Investments in innovations ...?

Exactly, there in particular. We were resolute in continuing to push forward with our transformation in 2019. We spent more than seven percent of our sales on research and development.
“It is my opinion that there is no alternative to investment in a sustainable future.”

And what did the year look like from an economic standpoint?
Thanks to our determined efforts, we were able to improve our performance in the second half of the year. We reduced costs and adapted our capacity to our sales volume, bringing income data to within our expectation corridor, which was corrected mid-year. However, our objectives differ from where we are, so it is necessary for us to continue to work on our costs in particular.

With the planned purchase of WABCO, ZF would grow very significantly for the second time within just a few years.
The possible integration of WABCO represents an important milestone for us. We expect the acquisition to take place shortly. With WABCO’s products, we would be able to demonstrate autonomous driving in commercial vehicles much more quickly. We could offer our customers an overall system from driveline with electric drive and chassis to axles with brakes and steering system. In addition, this planned acquisition gives us even more strength, which we will need to continue down our chosen path. And with our #Mobility-LifeBalance campaign, we are clearly demonstrating that we want to contribute our ideas in order to shape the mobility of the future.

The acquisition is costing ZF around €7 billion...
Last October, we were able to raise a total of €4.8 billion on the capital market in order to make the purchase. Significantly more investors than we needed wanted to subscribe, which means that the market sees the potential of this acquisition.

How do you get a company as broadly positioned as ZF up to speed – given the faster pace?
Our decentralized structure means that we are already significantly faster than it might appear at first glance. This is necessary just due to the high level of quality in our industry. Nevertheless, we too need to increase our speed. To make this possible, we are currently implementing a number of programs to improve operational fitness and are once again greatly increasing our efficiency and agility.

Are the employees backing this approach?
I am well aware that successful implementation of such projects requires a great deal of commitment in the Group units, which is why I am pleased that the corporate units, as well as the employees, are providing full support as we go down this sometimes difficult path. It is understandable that fear of the unknown is sometimes stronger than curiosity about the new and unknown, but it is precisely these steps into an unknown future that we now need to take. The speed of change requires that we improve and simplify processes, evaluate our portfolio of goods and services, make changes to locations, integrate companies into the Group, discontinue some activities and systematically develop new fields of knowledge and technology. We are doing all these things – with a great deal of determination but also with a sense of proportion.

The global climate is now also presenting ZF with significant challenges.
ZF fully supports the objectives of the Paris Climate Agreement. We pursue a clear strategy that involves using our technology in order to be part of the solution to climate change. However, we also need to do more to reduce our own carbon footprint. Despite the weak economic situation globally and the many campaigns with which we are currently reducing our expenses and adjusting cost structures, we will continue to invest in sustainability in 2020. In doing so, we will concentrate our effort on areas in which action is needed now. We will utilize every possible approach to reduce CO₂ emissions. It is my opinion that there is no alternative to investment in a sustainable future.

The climate debate is giving momentum to electromobility. Will we be traveling primarily in electric vehicles in the future?
Electrification is a key path for the future, of course. Nevertheless, we are convinced that an essential requirement for real innovation is technology neutrality. Our strategy therefore includes more than just one drive technology, such as battery electric vehicles and plug-in hybrids. We believe in purely electric drivelines in passenger cars and commercial vehicles for customers in markets with suitable infrastructure and favorable geography.

And what about hybrid technology?
We see plug-in hybrids as an important solution for bringing electrification to the mass market. The plug-in hybrid offers the best of both worlds: local zero-emission driving and the
ability to cover long distances. The coming generation of plug-in vehicles will provide a purely electric range of around 80 kilometers and more. This will result in complete electrification of city traffic and daily commuting without fear of limited range. It’s a great solution for households with just one car that has to serve all mobility needs.

What does this mean in terms of jobs?
It is hybridization in particular that is the lever needed to transform our industry and secure jobs. If the EU’s Green Deal is to be a success, plug-in hybrids must be a key component of its strategy. In other words, if we set the right political focus, the Green Deal could even trigger many new jobs.

In your opinion, how far along is the industry on the path to automated driving?
Automated driving will come bit by bit, first in commercial vehicles by mid-2020, and then in individual passenger transportation, once people have overcome their understandable reservations.

And where is ZF in all of this?
As an example, we are currently putting a great deal of resources into the development of autonomous shuttle vehicles because they strike a chord in urban areas. Such vehicles can solve primary problems of traffic congestion and emissions while simultaneously increasing the comfort and availability of public transportation on highly frequented lines. This new means of transport has the potential to fundamentally revolutionize mass transit.

However, automated driving is also changing the way we think about the safety of passengers. New seat positions require safety technologies with the ability to adapt. That’s why our engineers are currently redesigning technologies such as seat belts and airbags to meet the requirements of the future realities of travel. In the future, active and passive safety technologies will operate hand in hand. We have committed ourselves and our company to making “Vision Zero”, i.e. zero accidents, a reality.

The first months of the new year are already behind us. What does ZF plan to achieve in 2020?
We will seamlessly continue to work on the measures and topics of the previous year. We will keep up the pace, continue to work on improving our performance and intensively invest in the technologies of the future. Our “Next Generation Mobility” strategy will show us the way forward. In parallel with this, we will forge ahead in adapting our structures and reducing costs. Campaigns are underway in all areas to make the company even more effective and faster. This is crucial, as revenue will remain the same and we need to save elsewhere to compensate for higher expenditure on safeguarding our future, that is, R&D, electromobility and automated driving.

What else will be keeping you busy, and how do you plan to achieve your ambitious goals?
We want to get even closer to our customers in the future. Our decentralized positioning and new offers in the areas of service and customer support will help us achieve this. An important milestone here was the restructuring of our sales organization, which was completed in 2019 and is to take full effect this year. We can only achieve all of this with motivated employees who are willing to make changes. If we want to help shape the future of mobility, this future must first move our hearts and minds. That’s how ideas are born, and that’s how we will acquire the strength we need.
INVESTMENT IN THE FUTURE OF MOBILITY

The way people get around is currently undergoing fundamental changes. ZF sees this transformation within the industry – the greatest upheaval since the invention of the automobile – as an opportunity. The company has thus consistently aligned its product portfolio to the needs of “Next Generation Mobility.”
There is no doubt that the question of new forms of mobility is currently one of the most widely discussed topics worldwide. The automotive industry is experiencing a technological transformation accelerated by digitalization as well as unprecedented intensity of demand for more and better protection for the climate. This global trend is affecting all social classes and age groups. The focus of what people want today is that mobility be designed in such a way that it will release into the atmosphere considerably lower quantities of carbon dioxide in particular.

"ZF clearly supports the goals of the Paris Climate Agreement. If we want to mitigate the consequences of climate change, we need to find and implement solutions that society can accept now," says Wolf-Henning Scheider, CEO of ZF. As a supplier of products for a wide range of mobility segments as well as for industrial technology – such as wind power – the company can make a significant contribution to this massive task.

To this end, the technology group is investing in the four technology fields that are particularly promising for the future, as they each make a major contribution to the mobility of tomorrow. These fields are automated driving, electromobility, vehicle motion control and integrated safety. ZF consistently relies on digitalization to create new opportunities for its products as well to improve its processes within the company.
The logistics industry and new mobility providers will be the first to drive autonomously. Owing to financial and legal concerns, however, private passenger cars on public roads will be automated to a lesser degree. ZF therefore offers suitable products for each context of use.
It was a shocker: An annual average salary of $87,500 – nearly €79,000. That is the amount offered by retail giant Walmart to recruit truck drivers, which is 70 percent more than the standard wage. Why? Simply put, there is an acute lack of employees in the logistics industry. According to forecasts, there will be a shortage of approximately 100,000 truck drivers by 2022 in the United States – and the situation is comparable in Europe. German carriers alone currently have up to 60,000 vacancies.

An inconsistent legal framework
Autonomous systems can solve the global personnel bottleneck. For that reason, management at ZF has decided that highly automated driving at level 4 and above will initially prevail for commercial vehicles and people movers. “The higher system costs can be illustrated for these market segments in realistic business cases,” says Torsten Gollewski, Head of Autonomous Mobility Systems at ZF. In addition, highly automated vehicles are already allowed to drive in limited-access areas, such as depots or airports, where they are used to maneuver semi-trailers or taxi guests on the tarmac. In contrast, however, the legal framework permitting vehicles at level 3 or higher to operate normally on public roads has still not been established in all major markets. “In addition to the lack of legal authorization, the costs of highly automated driving systems are not in line with a cost-benefit ratio that would justify their use in private passenger cars,” stresses Torsten Gollewski.

ZF’s diversified strategy
Depending on the area of application, ZF is pursuing a unique strategy for its turnkey solutions for automated driving. While the focus is on level 4 and higher for commercial vehicles and people movers, the company is currently pursuing level 2+ for passenger cars. ZF defines level 2+ as an intelligent configuration of level 2 in a flexible and scalable package. “In the highest expansion stage, referred to as ZF coPILOT, we provide a level of quality for partially automated driving designated as level 2+, which would otherwise only be attainable through costly integration of level 3 functions,” says Torsten Gollewski.

Software as a success factor
In the coming decade, software will prove decisive as a differentiating criterion within the automotive industry. This applies especially to systems that enable higher levels of automated driving. ZF is therefore working on software modules for numerous use cases to increase the functional scope and added value of its products. “The crucial factor of success is the ability and competence to provide and network all of the key components necessary for the various levels of semi-autonomous and autonomous driving, and thereby achieve a higher degree of safety and comfort,” explains Wolf-Henning Scheider, Chief Executive Officer of ZF Friedrichshafen AG.

For passenger cars, ZF is focusing on the expansion of semi-automated driving functions under the term Level 2+.
All systems from a single source
ZF provides all requisite components for automated driving, as well as the necessary systems expertise – from sensor systems to data analysis and control electronics to actuating elements in the drive, brake and steering systems. This allows the technology company to provide its customers with everything from a single source – from cutting-edge advanced driver assistance systems to level 4 functionality. In addition to conventional automotive manufacturers, this knowledge is especially attractive to new automotive customers and mobility providers, who, due to a lack of in-house development resources, can rely on ZF as a partner for automated driving. For example, ZF received a delivery order in 2019 for a level 2+ system that will be used in a volume production passenger car from this year on. ZF was also commissioned by a commercial vehicle manufacturer to develop an autonomous driving system for a truck tailored to its specific needs.

Sensor technology: 3D data through radar and LIDAR
Sensor systems are the foundation of all automated functions used to monitor the outside surroundings and the vehicle interior. ZF is thus working to further develop cameras as well as radar and LIDAR sensors. Two new developments in particular are drawing attention. First, the Group announced that its first 3D full-range radar is already in the validation phase. With a total of 192 channels – 16 times as many as standard radar – it records several thousand data points per measuring cycle and, for the first time, also the angle of elevation; ZF’s full-range radar can thus “see upward.” The result is a detailed, spatial representation of the environment, which allows for much better recognition and classification of objects. Second, ZF is collaborating with a partner to develop solid-state LIDAR, which will enable a high-resolution, three-dimensional image of the surroundings to be captured within a radius of 250 meters, regardless of light and weather conditions.

Mainframe computer: ZF ProAI RoboThink sets standards
In order to interpret the enormous dataset generated by the sensors and to develop driving functions based on it, the vehicle requires enormous computing power, the amount of which depends on the particular degree of automation. ZF has therefore scaled the ProAI mainframe computer product family accordingly. While the ZF ProAI Basic reliably satisfies the requirements of the NCAP 2020 safety standard, the first-rate ProAI RoboThink equipped with artificial intelligence is currently the most powerful platform for autonomous driving, with up to 600 trillion arithmetic operations per second. This allows Mobility-as-a-Service applications to run on it – as required, e.g., for autonomous ride-hailing.

“Integrating colleagues from different cultures into a team is crucial for the success of global ZF projects such as our Automated Driving Shuttle.”

Georg Mihatsch, Car Body Team Leader on the Automated Driving Shuttle innovation prototype.
14 passengers have been transported autonomously by 2getthere from 1997 until today.

99.8% proven availability in daily operation, regardless of weather conditions.

ZF acquires 2getthere
To expand its capabilities in the growing Mobility-as-a-Service market, ZF acquired a majority stake in 2getthere in March 2019. The Dutch company specializes in mobility services that use driverless shuttles, and has established autonomous people and cargo transportation systems that have already been used to travel more than 100 million kilometers. The systems operate globally in ports and airports. In Rotterdam's Rivium Business Park alone, autonomous people movers from 2getthere have safely transported more than eight million passengers since 1999. In 2020, six new shuttles will be put into operation – and in 2021, they are to be put into service in mixed traffic for the first time.

40+ KM/H

The 3rd generation vehicles are the only autonomous shuttles that travel at such high speeds.
To school, to work and back? A modern plug-in hybrid can cover most everyday distances with just one battery charge.

ZF offers a wide range of electric and electrified drive solutions for various vehicle segments. Among these, a special focus is placed on hybrid drives, as they represent a technical solution for quickly bringing electromobility into daily life.
purchase an electric car? Despite its undeniable advantages, the young family man Ernesto Cruz could not bring himself to do it. The hefty price was not the issue, but rather his reservations about poor range and the tedious search for charging stations. However, he could not get the idea off his mind. A few months later, rushing into the driveway with his son in tow like every weekday, he went through the morning routine with his hybrid electric vehicle: unplug the charging cable, get in, drive off. Almost silently they leave the residential area in suburban Barcelona — first to school, then into the city, and later in the afternoon to the shops with Ernesto’s wife Ines. Welcome to the world of “Next Generation Mobility.”

**EVplus brings electromobility into everyday life**

With the EVplus concept vehicle, ZF is presenting a solution for users like Ernesto Cruz: a plug-in hybrid electric vehicle with a reliable electric range considerably greater than 100 kilometers. This allows his family to use their hybrid almost exclusively in electric mode for all everyday errands. If a trip to visit relatives in Madrid is on the agenda, the internal combustion engine offers a proven alternative for the roughly 600-kilometer journey.

**ZF electrifies everything**

EVplus is just one example of how the aims of the Paris Climate Agreement can be achieved through solutions that will be accepted by society. Electric drives are a crucial factor when it comes to carbon-neutral mobility. “We do not prioritize a single form of electrification, but instead develop various drive types using a wide-ranging approach that embraces technology,” says Chief Executive Officer Wolf-Henning Scheider of ZF’s approach.

Whether hybrid or purely electric drivelines, e-bikes, passenger cars, trucks, buses, ferries, Formula E race cars or construction equipment, ZF engineers develop the optimal electric or electrified driveline for every possible need in a service portfolio ranging between 250 and 500,000 watts. Both standard vehicle manufacturers and new mobility providers benefit from the high degree of systems expertise in electric drives and transmission engineering.

**Micromobility: e-cargo bicycles are gaining traction**

Sachs Micro Mobility Solutions GmbH, a ZF joint venture, has unveiled its powerful Sachs RS motor for electrically assisted bicycles. With 110 newton meters, it delivers almost 50 percent more torque than standard performance motors and is suitable for both e-mountain bikes and e-cargo bicycles. E-cargo bicycles in particular could noticeably alleviate inner-city traffic congestion.

**Passenger cars: consistent development of hybrid and electric drives**

ZF’s new, fourth-generation 8HP automatic transmission was initially developed for plug-in hybrids, which served as the basis for developers in deriving variants for mild hybrids and for exclusive use with internal combustion engines. With 160 kilowatts (218 HP) of power, the peak electric output is 60 percent higher than the previous generation. Together with sufficient battery capacity, this creates a foundation for electromobility that is suitable for everyday use.
Greater variability thanks to 2-speed drive for electric cars
Conventionally, electric drives are optimized either for high torque or high top speed. In mid-2019, ZF introduced a 2-speed drive that integrates the electric motor, transmission and power electronics into a single housing. Thanks to the 2-speed transmission, the drive provides both improved acceleration and a higher top speed, which simultaneously increases efficiency and range by up to five percent.

Commercial vehicles: electric drives for city buses are in demand
The CeTrax central drive and AxTrax AVE electric portal axle offer attractive electric drive solutions for delivery trucks and buses. ZF is the market leader for the electrification of buses in Europe, and orders for AxTrax AVE doubled this year compared to the previous year. Vehicles with portal axles featuring two powerful 125-kilowatt (170 HP) electric motors can now be found traveling the roads of Milan, Berlin and London as well as of many other municipalities and cities.

Electrified construction equipment and clean electricity from wind power
The advantages of electrification are particularly apparent in urban construction sites, as they produce no exhaust gas and keep noise emissions to a minimum. That relieves both construction workers and residents alike. ZF therefore showcased an electric vehicle drive system for off-road machinery, such as skid loaders, and an electric drum drive for cement trucks at BAUMA, Europe's leading trade fair.

Electric drives need power from renewable sources in order to actually be zero-emission. With its gearboxes for wind turbines, ZF is making an ever-increasing contribution to the production of clean energy. The Group delivered the first wind turbine gearbox exactly 40 years ago, and today roughly 25 percent of all systems worldwide contain a gearbox from ZF.

FOCUS: DIGITALIZATION

Intelligently managing electric fleets
Intelligent power and charging management plays a particularly important role for electric vehicles operating as a fleet. That is because the available charging stations and resulting downtimes must be cleverly integrated into route planning, which crucially relies on real-time data analysis. Openmatics, ZF’s open connectivity platform, provides very good networking and functional options, making it particularly suitable for fleet management of electric vehicles. The functional scope of Openmatics is practically limitless. Together with vehicle manufacturers, ZF can implement functions such as predictive maintenance and over-the-air updates of component software.

Electrification Significantly Reduces Emissions

Motorsports: Formula E testing ground
ZF first developed the complete, 250-kilowatt-strong (340 HP) electric driveline for the Formula E race car used by the Monegasque team Venturi for the 2018/2019 season. The vehicle was equipped with the first-ever ZF-built power electronics with high-performance modules made of silicon carbide. The Group is currently developing this semiconductor for series applications, and the resulting increase in efficiency with a constant battery capacity is expected to increase the vehicle range by 5 to 10 percent. In the 2019/20 season, ZF continues its commitment to Formula E as a partner of Mahindra Racing.

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The AxTrax AVE electric axle is also used on London city buses. It is an ideal solution for making inner-city public transit locally emission-free.

More than 150 M kilometers have been covered on a locally emission-free basis by buses equipped with the AxTrax AVE electric axle.

ZF’s electric 2-speed drive provides more range, better acceleration and a higher top speed.

“For a developer there is nothing better than when your idea materializes after only a year of development.”

Dr. Stephan Demmerer, Head of Advanced Engineering Electromobility, speaking about ZF’s Innovation Vehicle with electric 2-speed drive.
The chassis plays a major role in ensuring safety, comfort and efficiency of a vehicle.
Research on motion sickness is within ZF’s purview, and it incorporates the lessons learned into the development of future products for autonomous driving. With “Flying Carpet 2.0,” the technology company has already introduced a sophisticated chassis concept for the car of tomorrow.

ike on a wild roller coaster ride, the car stops abruptly before quickly accelerating again to continue its swerving way. Despite being buckled in, the passenger in the back seat slides back and forth, his upper body jerked by the forceful movements of the car. He nevertheless keeps his eyes focused on the tablet PC in his hands, on which he has to accomplish various tasks during the ride. Four cameras as well as sensors attached to his body record the physical condition of the test subject, who also continuously evaluates if and how intensely he experiences nausea caused by the driving on a scale of 1 to 10.

Recognizing physical changes early on
Why this ordeal? This kind of unpleasant activity is how scientists gather new insights about the bodily reactions of car passengers in order to develop strategies for improving ride comfort in the future. After all, two out of every three passengers suffer from unease and dizziness to varying degrees. This phenomenon is known as motion sickness, or kinetosis in medical jargon. Because motion sickness has not yet been adequately researched, ZF is collaborating with neurotechnology scientists from Saarland University and the htw saar University of Applied Sciences to detect symptoms associated with motion sickness at an early stage.

A high-performance computer integrated into the Motion Sickness Research Vehicle, which has been specially outfitted by ZF, records a large amount of physiological measured values as well as camera images and measurement data related to the driving dynamics. The objective is to develop analysis algorithms that detect when occupants start to feel sick, in order to derive intelligent vehicle functions that counteract nausea or completely prevent it from occurring. To this end, humans are at the center of ZF’s research, as Florian Dauth explains. He oversees activities in the field of Human-Centered Vehicle Motion Control in Advanced Engineering at ZF. “We want to be able to detect motion sickness in individuals and develop countermeasures based on a passenger’s current condition.”

Adios, nausea: motion sickness during autonomous driving
Knowledge about motion sickness is especially relevant when it comes to highly automated or fully automated driving. Instead of a human driver, autonomous driving is controlled by a control system in the vehicle, enabling occupants to comfortably do other things during the ride, such as read a book or watch a movie. However, it is right at that moment when motion sickness usually occurs: when the driver is no longer focused on the road, resulting in perceptual inconsistencies. The balance organ in the inner ear senses a movement that is not confirmed by other sense organs such as the eyes. This is most likely to happen when a passenger is concentrating on a screen or a book.

FOCUS: DIGITALIZATION

cubiX – Combining Sensors and Actuators
The “Flying Carpet 2.0” chassis concept required ZF to find a way to intelligently and centrally control all active components involved. The company’s proprietary cubiX software held the key. The regulation algorithm networks and coordinates all chassis actuators. Since cubiX is based on a modular design, it can be individually adapted to the requirements of each automotive manufacturer and supports components from both ZF and third parties. With “Flying Carpet 2.0,” ZF has created a reference project that demonstrates what the software is capable of doing when the corresponding chassis components are available. cubiX optimizes vehicle handling at a critical point thanks to the centrally controlled interaction between the individual actuators. This not only takes vehicle control to a whole new level, but also increases safety, for instance, in the case of poor road conditions or emergencies.
The main challenge of this project was to combine the different specialist knowledge of multiple experts and develop a solution out of it.”

Mohamad Alayan, Project Manager, ZF Motion Sickness Research Vehicle
In this situation, the human body reacts in the same way it would if it were poisoned. The new freedoms offered by autonomous mobility can therefore only be enjoyed if well-being is ensured during the drive.

**Keeping driving dynamics under control with technology and system expertise**

Technically, ZF is well positioned in this important field. The Group not only provides all the components for Vehicle Motion Control – such as brakes, steering system and chassis – but also the necessary systems expertise, which allows the driving dynamics of passenger cars and commercial vehicles to be perfectly coordinated. Through intelligent networking, the individual actuators are precisely controlled and used to make the motion of the car body as independent of driving conditions as possible.

**Smooth sailing thanks to “Flying Carpet 2.0”**

ZF has already demonstrated the potential of intelligent networking using a test vehicle. “With our ‘Flying Carpet 2.0’, we have developed a chassis concept that can completely control all longitudinal, transverse and vertical vehicle movements,” says Dr. Christoph Elbers, Vice President of Car Chassis Technology Development at ZF. This “flying carpet” considerably reduces unpleasant movements caused by potholes, road bumps or abrupt braking maneuvers. The results are a boon for comfort and safety.

**Active damping system functions predictively**

The technical foundation for this extraordinary chassis is the intelligent interaction between various active and semi-active systems that predictively iron out adverse movements of the vehicle body. Key to this is the sMOTION fully active damping system, which uses four actuators to adapt the suspension movements of each individual wheel according to the driving situation and road surface. For example, in contrast to conventional or semi-active dampers, the sMOTION actuators can maintain stability in the car body through movements that actively counteract road bumps.

**The intelligently connected chassis of the future**

But “Flying Carpet 2.0” can do even more. Its integrated Active Kinematics Control (AKC) rear axle steering provides more safety, dynamics and increased maneuverability. At low vehicle speeds, AKC greatly improves maneuverability by steering the rear axle in the opposite direction of the front wheels. If the vehicle is moving faster, the system steers the front and rear wheels in the same direction to provide greater directional stability and passenger comfort. Together with sMOTION, AKC prevents the rear end from swerving when driving quickly around curves. The concept also includes steer-by-wire power steering, which is currently still a prototype, and the active Integrated Brake Control (IBC) brake system. With its networked chassis components, the “Flying Carpet 2.0” concept impressively demonstrates ZF’s readiness to tackle the requirements of next-generation mobility.
Each year, some 1.35 million people die on the world’s roads. With its active and passive safety systems, ZF is making a major contribution to help reduce the number of traffic injuries and fatalities.
United Nations (UN) Secretary-General António Guterres had a clear message when he addressed the public on the occasion of the World Day of Remembrance for Road Traffic Victims: “Immediate measures remain an absolute necessity,” the Portuguese leader said, admonishing the world community to do better in this area. “On this day of remembrance, I call on everyone to work together to overcome the global crisis of traffic safety,” the Secretary-General said on November 17, 2019. The underlying reason for this appeal is an alarming statistic: Every 24 seconds on average, someone loses their life in road traffic somewhere in the world.

Major safety hazards in poor countries

The World Health Organization’s “2018 Global Status Report on Road Safety” shows that road safety is particularly deficient in poor countries. While the group of countries with a low per-capita income accounts for only one percent of the global vehicle population, these countries account for 13 percent of annual fatalities in the global statistics. By way of comparison: Although 40 percent of all vehicles are on the road in high-income countries, the proportion of road deaths there is dramatically lower at just seven percent.

Goal: making vehicles safer around the world

There are many different reasons for the above-average number of road traffic deaths in poor countries. “Lack of laws, poor infrastructure, insufficient road safety education and lack of safety standards for vehicles,” explains Etienne Krug. He heads the Department of Noncommunicable Diseases, Disability, Violence and Injury Prevention for the World Health Organization (WHO). Consistent use of safety systems can help to improve this unsatisfactory situation. These systems include active and passive safety systems, Electronic Stability Control (ESC), front- and side-impact protection for occupants, and frontal protection for pedestrians.

Using technology to achieve “Vision Zero”

Advanced safety systems are now nearly always necessary for attaining vehicle test protocols and high consumer safety ratings in Europe and most mature markets. As a result, with an average of 49 road deaths per million inhabitants, European roads are the safest in the world. “Vision Zero” is the avowed long-term goal of the European Union (EU): By 2050, the number of people killed or seriously injured should be close to zero. To this end, the EU is pursuing the “Safe System Approach”. This approach provides for the development of a mobility system that can better compensate for human error. It pins a great deal of hope on advanced driver assistance systems, such as emergency brake assistants, intelligent speed limiters and blind spot monitors.
countries – primarily those with high per-capita income – have already implemented all seven of the vehicle safety standards recommended by the UN.

“In our Integrated Safety Vehicle technology demonstrator, we implement new concepts for safety and comfort.”

Sandra Wolter, Project Manager for the Integrated Safety Vehicle at ZF
ZF concept: identifying hazards early on
The ZF Integrated Safety concept goes one step further: The technology company develops intelligent systems with which vehicles are capable of identifying hazards and responding to them at ever earlier points in time. Using sensor technology and artificial intelligence, these systems can detect and assess traffic situations – and help prevent accidents or mitigate their consequences with active and passive safety technology. This concept of Integrated Safety helps protect not only the occupants of the vehicle but also other road users such as pedestrians or cyclists.

Intelligent assistants help to prevent accidents
Modern advanced driver assistance systems from ZF help to mitigate dangerous situations. One example is the “Automatic Emergency Braking” (AEB) system. As the sensors detect a hazard, the AEB system can automatically apply the brakes and bring the vehicle to a stop. If the sensors detect that a collision can no longer be avoided even with emergency braking, the Assisted Emergency Steering Control is designed to automatically steer the vehicle into a free lane or onto the hard shoulder.

Innovative airbags for even greater protection
Naturally, it’s not possible to prevent every accident, but innovative technology can help limit the consequences. For this reason, ZF is taking steps such as continuously expanding its airbag range. For example, ZF’s recently developed ProSIP pre-crash protection system can create an additional lateral crumple zone a few milliseconds before a collision using an airbag mounted on the outside of the vehicle. For occupants, this can reduce the severity of the consequences of accidents by up to 40 percent. This is made possible by linking the airbags with the vehicle’s environmental sensors and using algorithms to determine whether a crash is imminent and decide at lightning speed whether the airbag needs to deploy or not.

It’s not just conventional airbags such as driver or passenger airbags that are constantly subject to further development but also new types of airbags such as “far-side” airbags. They are designed to prevent the driver and front passenger from colliding and keep them from hitting their heads together after a side impact. Placed on the inward-facing side of the driver’s seat, this system also helps to protect the driver when a side impact occurs while they are sitting alone in the car. In this case, the far-side airbag prevents the upper body from being flung over the center console. Depending on the severity of the accident, the seat belt can only hold the pelvis in the seat.

With these and other developments, ZF is presenting vehicle manufacturers worldwide with a wide range of options for improving active and passive safety, thus bringing “Vision Zero” closer to reality for today’s drivers and passengers.
SUSTAINABILITY AND CLIMATE PROTECTION GO HAND IN HAND
Climate protection is one of the most important issues of our time. Young people are taking to the streets every Friday in protest over climate change, investors are now including corporate actions that are damaging to the environment in their exclusion criteria, and the European Union is planning a Green Deal that aims to make Europe the first carbon-neutral continent by 2050.

The automotive industry is in transition

Entire business sectors are now undergoing a period of transition, and this is proving particularly challenging for the automotive industry. Today, the traffic sector in the OECD member states alone accounts for over a quarter of global greenhouse gas emissions. For Hildegard Müller, President of the German Association of the Automotive Industry e.V., it is clear that the sector is facing “profound changes in the face of digitalization, shifting mobility patterns and particularly the considerable challenges the issue of climate protection poses.” However, she is convinced that this is “a challenge that the sector is able to face. As the German automotive industry itself professes, the responsibility for people and the environment no longer ends at the factory door; rather, it must be anchored throughout the entire supply chain.”

ZF is shaping the transformation

ZF is playing an active role in shaping the transformation. The “Vision Zero” strategic objective stands for zero emissions and zero road traffic accidents. Not only is production at ZF going climate-neutral. In January 2020, Wolf-Henning Scheider, CEO of ZF, announced that, by 2040, the entire value chain – from the supply chain to the use of the products – is to become climate-neutral. This is part of ZF’s commitment to the Paris Climate Agreement, which sets out a framework to keep global warming below 1.5°C.

ZF’s climate strategy

ZF aims to be climate-neutral by 2040 for all three “scopes” of the Greenhouse Gas Protocol. This means that by 2040, all of the roughly 240 ZF locations will not generate any CO₂ emissions either on their own or through the purchase of electricity (Scopes 1 and 2). By 2030, ZF aims to reduce these CO₂ emissions by 50 percent compared to 2018. To do so, we are targeting a 20 percent increase in energy efficiency in our plants and will procure more of our power from renewable energy sources. At the same time, we will reduce emissions across our entire supply chain and minimize the environmental impact of our products (Scope 3).
The protests are organized by students and held around the world. At the first-ever international climate strike on March 15, 2019, nearly 1.8 million people participated in the “Fridays for Future” demonstrations.

ACCEPTING RESPONSIBILITY
IN THE COURT OF PUBLIC OPINION

How do demands for greater climate protection affect our day-to-day business? Research and Development, Materials Management, Production and Sales offer insights.
Research & Development
Continuous demographic and economic growth requires efficient use of our resources because, after all, the Earth is not growing with us. That is why, in line with the “Design for the Environment” approach, ZF takes aspects such as materials management, reparability and recyclability into account when designing its products.

Automated driving and e-mobility are already improving efficiency in megacities. However, the mobility of the future requires a variety of innovative approaches. For this reason, in addition to pure electromobility, ZF also offers systems for hybrid and fuel cell drives for commercial vehicles. In the industrial field, we are currently working on solutions such as sustainable concepts for construction and agricultural machinery as well as wind power.

Sales
Our customers are being challenged to reduce emissions in the mobility sector. Many of them have introduced strict sustainability standards as a result. In order to master this technological shift, they need a strong partner with the right expertise. However, in order to be successful in the long term, supplier systems must pursue similar sustainability and climate protection objectives. Effective commitment to sustainability on the part of ZF is the best foundation on which to build this success.

Materials Management
Supply chains are extremely complex and only a small portion can be directly controlled. In order to achieve carbon-neutrality, it is therefore extremely important to establish transparency and understand material flows and manufacturing processes inside and out. ZF is taking a step-by-step approach, concentrating initially on the materials with the largest CO₂ emissions: steel and aluminum.

When it comes to the selection of raw materials and components, ZF looks for solutions that protect human rights and the environment, and combine safe mobility and economic viability. For example, we rely on innovative suppliers and work together with them to develop alternative materials and designs.

It is up to every individual to ensure that ZF becomes climate-neutral by 2040 at the latest. Everyone responsible for making a decision must make an effort to help us achieve this goal. At the same time, all corporate units are asked to do their part.

This will require a clear plan for how we will achieve our goals, as well as individual responsibility and, most of all, flexibility.

Christine Betz, Head of Sustainability

“A company must be sustainable in all areas in order to be successful over the long term.”

Production
Unlike with supply chains, when it comes to production locations, ZF can exert a direct influence: By 2030, ZF aims to reduce emissions by 50 percent compared to 2018. ZF intends to be climate-neutral by 2040 at the latest. Energy efficiency, which accounts for around 20 percent of these emissions, will play a major role in these efforts, as will the purchase of green energy. We will also improve internal transparency and share experience with best practices in a targeted manner in order to identify and tap into savings potential across all locations.
As a signatory of the United Nations Global Compact, ZF is committed in particular to promoting the protection of human rights, labor standards, environmental protection and the fight against corruption.
ZF advocates for responsible business practices and the preservation of the environment. We have defined the most important fields of action and objectives of our commitment in a sustainability program. We have made a lot of progress in recent years, including in 2019.

**Supply chain: integrated sustainability**
A large part of the added value comes from cooperating with our suppliers, including large corporations but also small family businesses. ZF actively cultivates these partnerships. It is therefore important to us that our business partners respect and promote the same values. In order to be able to fulfill its duty of care more consistently, ZF has reorganized the sustainability management of its supply chain and initiated extensive measures: Numerous processes have been reviewed, standardized and adapted. We have launched a pilot project with strategic suppliers that is designed to achieve a more reliable sustainability assessment of all suppliers. Negative events are to be identified more quickly via social media monitoring in order to take appropriate remedial action.

**Employees: reduced Lost Time Accident Rate**
We have also made further progress on the way to a global leadership and learning culture. We have set up a digital learning platform, introduced an active feedback system and harmonized further training for executive managers – measures that promote agile management at ZF and bolster our innovation performance. In the area of occupational health and safety, our approach of behavior-based safety combined with workshops for executive managers has had a major impact, reducing the Lost Time Accident Rate from 6.5 to 3.8, which is more than 40 percent, over the past three years.

Since diversity is an important driver of innovation and creativity, we organized a Diversity Day for the first time in 2019. Many ZF locations hosted events on the topic as part of the worldwide “Join the Conversation” campaign. The objective was to stimulate discussions about how diversity can contribute to ZF’s success.

**Production: climate strategy development**
Production activities in 2019 were shaped by the strategy for climate neutrality. After all, many questions in terms of implementation of the strategy involved the 161 production locations around the world. In addition, the locations have also pursued many projects to improve their environmental performance. These often serve to improve energy efficiency further, as well as to conserve resources, reduce waste and increase the recycling rate.

**Products: presentation of new products**
In 2019, ZF was able to present a number of new developments, for example, for China: The electric central drive is designed for city buses up to 12 meters long or medium-duty trucks up to 12 tons, and takes into account the specific requirements of the Chinese market regarding safety, performance and cost-effectiveness. The new generation of the 8-speed automatic transmission takes the hybrid drive to the next level and reduces CO₂ emissions in road traffic.

ZF recognized early on that recycling products can save a lot of energy and material, and has expanded its capacities accordingly. Meanwhile, 15 ZF locations worldwide contribute to reconditioning a wide range of vehicle components such as brakes, transmissions, steering systems or torque converters, and making them available in OE quality. •

You can also find more information in the latest Sustainability Report.
Disruptive changes are currently shaking up the automotive industry. In order to turn the associated challenges into opportunities, ZF has been transforming its organization and work processes for some time now. Highly developed teamwork, with a pronounced sense of individual responsibility, ensures greater speed and customer proximity as well as improved quality of results.

Automation, digitalization, and electromobility have greatly changed the automotive industry in the blink of an eye. Another driving force for this change includes societal demand for more efficiency, conservation of resources and better climate protection. The objective and shared philosophy of the technology company is not only to respond to the abovementioned trends but also to play a crucial role in shaping the mobility of tomorrow.

Embracing change as a guarantee for long-term success
In order to meet the challenges ahead, ZF has been rolling out new approaches to work for some time now. First and foremost, this involves accelerating decision-making and using agile work methods on a grand scale. These and other measures are integral parts of the corporate strategy of "Next Generation Mobility." In this regard, a wide variety of initiatives have been launched in all areas of the Group, all of which strive to make the organization fit for "Next Generation Mobility." A specially established Transformation Office is coordinating and accompanying the change initiatives throughout the company.

Agile methods on the rise
Agile work is playing a key role in the change process. In this context, agility often means making changes to tried-and-true procedures in order to get better at what we do and to meet new challenges. New types of teams are relying on agile methods in day-to-day work, operating in a structured and autonomous manner and with a high degree of self-organization. This allows ZF to more quickly adapt to changing conditions and more promptly respond to new demands from customers.

"The world will never again move as slowly as it does today."

Dr. Michael Ebenhoch,
Head of Development for the Car Powertrain Technology Division
Development of transmissions in teams working independently

The example of the Development department of ZF’s Car Powertrain Technology Division demonstrates that this is not just a boring theory. This department had already started to make use of agile work methods in 2017. Divisional Head of Development Dr. Michael Ebenhoch explains why with a wink: “Many of us are getting the sense that the world around us is moving faster and faster. I have the opposite sense: The world will never again move as slowly as it does today.” For him it was and is clear that his employees need to think and work in an agile manner in order to continue down the path of success. With flagship project ETSYS – system software for the 8-speed automatic transmission of the 4th generation – the Development team was able to cut its teeth with agile teamwork. Strictly speaking, the ETSYS team consisted of seven interdisciplinary teams, whose members were also based in different locations and came from other divisions than just the Car Powertrain Technology Division. In the past, this diversity alone might have made cooperation significantly more difficult. Working with agile methods also means dividing the project task into small, manageable steps. At regular checkpoints, the project team reviews the interim results to determine whether the project is still on the right track.

“Our work is extremely customer-focused.”

Joost Peeters,
Development Project Manager

The next generation of the 8-speed automatic transmission: A project team developed this system software using agile methods.
track. This allows development concepts with little chance of success to be identified and halted at a very early stage. “Our work has a clear customer focus, but we are now also able to respond to changing circumstances with a great deal of flexibility and speed thanks to constant communication with and proximity to the customer,” says Development Project Manager Joost Peeters, citing one of the crucial advantages.

Top organization for promoting innovation
ZF is also breaking new ground in idea management in its Corporate Research and Development department, where the Innovation Factory, a team consisting of about 20 members, has its home. Its mission is to quickly transform innovative project proposals into real-life applications. Starting from a large number of employee ideas for new products, services and business models, those with the potential to be successful in the market are selected in a multistage process. “We’re responsible for the early phase of innovation development. That means we identify new trends, look for innovative start-ups in our strategic technology fields, and are the central point of contact for employees who want to submit an idea,” explains Dr. Eckart von Westerholt, Head of the Innovation Factory. When evaluating an idea, it is vitally important that it creates real economic and technological added value for customers and the company.

Competing for the product of tomorrow
In principle, any employee with an idea can submit an application to the Innovation Factory. To do this, they first fill out a one-page online form. It contains key information, such as a brief description of the customer problem that the idea is intended to solve, why ZF is best suited to implement this idea, the approximate framework in terms of time and budget, and the estimated market potential. Using six defined criteria, the Innovation Factory team then evaluates each project idea and selects the most interesting ones among them. Employees who clear this initial hurdle are assisted by the innovation specialists in preparing for a pitch event. These events take place every two months, and they are an opportunity for four to six idea providers to go before a jury and compete with their project ideas.

From idea to initial prototypes at top speed
Each winner – which is usually a team – receives support from the Innovation Factory financially and in terms of manpower in order to develop their idea into a first prototype within three to six months; this model is also known as the minimum viable product (MVP). Once the MVP is complete, the project team presents the results to senior management at a town hall event. If the MVP has the potential for an economically viable application, it goes into volume production development. “Last year, we organized as many as four pitch events and from these launched six innovative MVP projects – two of which were able to successfully transfer to the Group,” says von Westerholt, describing the success.

“We’re responsible for the early phase of innovation development.”

Dr. Eckart von Westerholt,
Head of the Innovation Factory
As a technology company, ZF depends a great deal on the ideas its employees dream up. Chief HR Officer Sabine Jaskula explains the ways in which the Group is responding in her area of responsibility to the current upheaval in the automotive industry.

Sabine Jaskula has been a Member of the Board of Management at ZF since early 2019. She is responsible for the HR and Legal Corporate Functions.
Electromobility, autonomous driving and digitalization are leading to sweeping changes in the automotive industry. What impact is this having on employees at ZF, and how is the company dealing with this upheaval?

Years ago, we began to prepare the company for this foreseeable situation by restructuring the organization. We honed our plans in 2018 with the Group strategy “Next Generation Mobility.” It serves as a compass for the company by clearly stating that ZF is putting its focus on the four core fields of electromobility, autonomous driving, Vehicle Motion Control and integrated safety, all of which are linked by digitalization …

... which, however, only describes the core of the Group strategy. Right. However, Next Generation Mobility also contains guidance such as starting points for measures that relate to the employees: On the one hand, we need to draw up and operate outstanding business processes throughout the company; on the other hand, we need to rely on methods of agile teamwork where this is possible and makes sense in order to meet the challenge of the transformation.

Why is agile work so important? Our customers expect us to become faster. Since time is a commodity that is as scarce as it is expensive, we have to make the best possible use of the time available to us. At many points in the company, work can be transferred to teams acting on their own responsibility. This makes us significantly more flexible than if we just work within the usual hierarchically organized line organization.

But it doesn’t end there. Another advantage of agile working methods is that the progress of the work is frequently checked. This allows us to identify undesirable developments more quickly and achieve the ultimate result faster and with better quality. By breaking the project task up into many small work packages, things like change requests and new requirements can also be easily taken into consideration. In addition, we are observing that employees find the work in project teams more varied, which in turn leads to increased motivation.

Are there other reasons for making a break with the old way of working? Actually, we are not really making a break with old ways; rather, we are simply adding a new operating system to our tried-and-true work methods. After all, in addition to the automotive customers we have always had, we now also have a growing group of customers we refer to as new automotive customers. These include mobility service providers and new suppliers of electric vehicles, which often do not come from the automotive industry. Because their requirements differ from those of a traditional OEM, we need different processes for them. Agile work methods also help us in this case.

What role do executive managers play in this scenario? For a start, superiors need to make their employees aware that there can be no more “business as usual” in view of the sea change currently underway in the automotive industry. It’s about using information to reduce any reservations or fears that may exist. Only employees who understand that the transformation also affects them and is part of their working life will be prepared to take new approaches. The topic of agile transformation is therefore also closely associated with changes within management. If we are to remain successful, we need more transparency here than we have had up to this point.

How can this objective be achieved? Greater transparency is closely linked with modern leadership methods and open communication. We are in the process of refining our understanding of leadership by focusing more on our culture of feedback and learning, among other things. But also by bringing our management development programs up to date. Superiors have to learn to lead virtual teams, provide them with more freedom and manage from a distance.

What is one way that managers can communicate more openly? To improve the flow of information in our hierarchical organization, we have launched a skip-level initiative. Two to four times a year, our senior management conducts an open dialogue regarding important issues with a smaller group of employees on all levels of the hierarchy. For the participants, this means receiving firsthand information and being able to ask open questions; in return, the speakers get unfiltered feedback and possibly some new perspectives on the topic.

More open communication certainly provides support for change, but is it enough? No, of course not. We obviously have to help our employees get the qualifications they need to face the new challenges. At ZF, we have been doing this for many years in a training organization that has long since been extended to include online training. We offer advanced training on every imaginable topic, ranging from classroom seminars to webinars and web-based training. Furthermore, we offer our employees around the world access to educational platforms such as LinkedIn Learning or SPEEXX, which contain a great deal of information on a wide variety of topics. This allows our employees to pursue needs-oriented education and expands our educational portfolio. All in all, I feel confident that ZF is coping well with the transformation by investing in the future: in its employees.

“At many points in the company, work can be transferred to teams acting on their own responsibility.”
BUSINESS DEVELOPMENTS

2019 IN REVIEW

In a challenging environment, ZF remains on a steady course. The financial targets, which were adjusted six months into 2019, were achieved. At the same time, ZF continued to invest heavily in future technology.
Group sales almost at previous year’s level

The global economy and the economic situation in the automotive industry in particular grew slower than expected in 2019. As a result, ZF adjusted its forecast halfway through 2019: The adjusted forecast aimed for sales figures between €36 and €37 billion, an adjusted EBIT between 4 and 5 percent, and a free cash flow between €0.5 and €1.0 billion.

At €36.5 billion, sales were slightly lower than in the previous year. The adjusted EBIT reached €1.5 billion. This corresponds to an adjusted EBIT margin of 4.1 percent. The fact that this figure is at the lower end of the target range is the result of greater research and development costs, start-up costs for new plants, mainly for e-mobility, and due to the cost structures that were aimed at growth at the beginning of the year. The adjustment refers to one-off effects from the purchase price allocation of the TRW acquisition, restructuring costs and M&A costs. The adjusted free cash flow totaled €803 million. The adjustments refer to M&A activities and investments in securities.

Acquisition of WABCO strengthens systems expertise in the commercial vehicle sector

One key milestone in pursuit of ZF’s further development was the acquisition of WABCO Holdings Inc. (WABCO) that was initiated in 2019. The planned acquisition of WABCO was initially secured by a syndicated loan agreement in the amount of €7.3 billion. Parts of this financing package have since been refinanced on a long-term basis via the capital market.

Increased investments

Despite the challenging market developments, in 2019 ZF continued implementing its strategy and increased its investments in future technology. The company invested €1.9 billion in property, plant and equipment. This corresponds to an investment ratio of 5.2 percent.

These funds went to the traditional areas of activity such as transmission applications (including hybridization), chassis systems, electronics, damper modules, brakes, steering systems and safety technology as well as to new technology fields such as electromobility and autonomous driving. Moreover, the Group invested in the construction and expansion of production and development buildings in existing locations. The Group invested €2.7 billion (2018: €2.5 billion) in research and development. This corresponds to a rate of 7.3 percent.

Increase in balance sheet total; equity ratio remains sound

In connection with the capital market transactions to finance the planned acquisition of WABCO and an increase in pensions, the balance sheet total increased by 16.7 percent compared to the prior year to a total of €32.4 billion. Compared to the previous year, equity decreased slightly to €7.1 billion. The equity ratio totaled 22.0 percent.

The ZF Group rests on a solid financial foundation thanks to its long-term oriented financing and affirmed and unused credit lines of €6.1 billion.
Economic development stable on the whole; risk levels remain considerable

After a noticeable economic slowdown in 2019, global growth is expected to stabilize at 3.1 percent during the current year. In developed economies, production is anticipated to grow by 1.5 percent. While the eurozone is forecast to remain stable at 1.2 percent, the U.S. economy is expected to experience a gradual slowdown to 1.7 percent. China's economic development is forecast to slow to less than 6 percent, in part due to the effects of coronavirus. The factors jeopardizing the economy are a possible escalation of trade conflicts, a no-deal Brexit and a prolonged spread of the coronavirus.

Sales expected to match prior year’s level

Assuming the abovementioned market developments and stable currency exchange rates, ZF is expecting Group sales between €35 billion and €37 billion for 2020. The sales forecast is based on flat development in the markets relevant to the Group. The adjusted EBIT margin is expected to land between 4.0 and 4.5 percent. Based on the planned development of the operating business, the intended investments and the continuation of consistent working capital management, the aim is to achieve free cash flow adjusted for company acquisitions and disposals of between €0.5 billion and €1 billion for 2020.

The planned acquisition of WABCO is excluded from the forecasts provided here.

Overall, ZF is still heading in the right direction

Bolstered by the trust of our customers, our close relationship with our suppliers and business partners and our dedicated, qualified employees who are willing to deliver outstanding performance and embrace change, ZF can rise to the upcoming challenges and look to the future with optimism.
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