Looking ahead: key trends for the automobile sector

cetim

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Vincent Caulet,
Global Automotive Market Manager, Cetim

Since it was founded more than 50 years ago, Cetim has been one of the key drivers of technological progress in the automotive industry. We have formed strong partnerships with OEMs (carmakers) and Tier 1 suppliers (component manufacturers) that have been responsible for many vital innovations in the car sector. Now innovations are coming quicker than ever. A revolution is under way, arguably more radical than any the sector has known. We can see the car of the future – of the near future – taking shape before our eyes: it will be connected, autonomous, shared and electric.

The pressure of environmental regulations – the industry must reduce CO_2 emissions to 95 g per kilometre per vehicle by 2020 – has accelerated the move to electrification. In two or three years, major carmakers will have electrified 50% of their range; in five to ten years, 100%. Choices will be made very soon with regard to the most favoured energy storage solution: battery technology is progressing fast, but hydrogen offers many advantages in the longer term.

Other changes will deeply affect how we use cars. We will tend to buy mobility services rather than owning our own cars, yet we will see cars as extensions of our homes, where we can relax or be entertained, or our working spaces. Comfort and connectivity will be key.

There are many implications in all of this for car design and manufacturing. Computer simulation and 3D printing are just two examples of how new digital technologies are helping the automotive industry to move forward at an unheard-of speed.

This white paper on the future of the automobile and the automotive industry highlights the views of a number of our partners. Experts and opinion leaders from OEMs, Tier 1 suppliers and the higher education sector were happy to share their vision of the future of the sector. I would like to thank them all warmly for the quality of their contributions. By reading these short interviews, I hope you will share our excitement about the automotive industry of tomorrow, an extraordinary adventure that is only just beginning.

Contents

1 Target zero emission: the industry aims to meet its objectives

The European target for emission control stands at 95 g of CO_2 per kilometre by 2020. New regulations have raised the bar for 2030. PSA's Carla Gohin discusses the challenges facing carmakers, and we also consider how progress in hydrogen, powertrains and smart composite materials will help achieve the targets.

Carla Gohin became Director of Research, Innovation and Advanced Technologies at the PSA Group in 2016.
She joined PSA in 1999 and most of her positions involved powertrain development. She had a spell as Technical Secretary of the Group's R&D division and was appointed Executive Secretary to Carlos Tavares, Chairman of the Group's Managing Board, in 2014.

With ever more stringent environmental regulations, what new challenges are facing carmakers?

Carla Gohin: All around the world, the automotive industry is under pressure to achieve an energy transition, and we have to go faster and faster. I believe the next five to seven years will see the fastest transition the industry will ever have faced. The European Union's regulations and policies are imposing electrification as the principal solution for achieving the targets it has set.
At PSA, we are focusing on electrifying our complete product line-up: within the next two years electric versions will be available for half of our models, and by 2025 our whole range will be electrified. We have based our strategy on the principle of multi-energy platforms, giving consumers a choice of conventional or electric powertrains in each segment. Some carmakers have taken a different option, creating dedicated electric platforms.

50%

Percentage of PSA models that will be available in their electric version within the next two years

We believe we still have to supply gasoline engines for consumers who have low access to charging points, which in many places has not developed quickly enough to keep pace with the automotive industry's fast rate of progress. The development of PHEVs (plug-in hybrid electric vehicles) over the next few years makes a lot of sense, with full electric mode for city-centre driving and availability of extended range for long journeys.

"The next five to seven years will see the fastest transition the automotive industry will ever have faced."

Carla Gohin

What other new technologies will play a role in achieving zero-emission cars?

C.G.: Electrification is the key in the short term, but we are also looking at other technology portfolios, of course. CNG (compressed natural gas) is one solution we're looking at. Hydrogen technology could enable us to meet our environmental targets, but the essential requirement is to be able to produce green hydrogen. I don't think this infrastructure will be fully in place until perhaps 2030. Battery technologies are also evolving, with improvements in terms of energy density and cost. We're working on the evolution of current technologies, because we still have to convince present-day consumers in terms of range, but we are also working on the next steps of lithium-ion batteries, as well as on solid-state batteries, which will probably be the next battery technology that we turn to.

What are the chances of meeting the environmental targets?

C.G.: The target to achieve by 2020 is 95 g of CO_2 per kilometre, but the European Commission recently set a new target for 2030, which consists of a 30% reduction in the objectives for 2020. So acceleration will need to go faster in the next decade.

The question is not whether we will achieve these goals: we are certainly capable of implementing the technologies that can achieve them. The issue is rather getting the whole electro-mobility ecosystem to go at the same speed. We will be producing electric cars, but unless there is heavy investment in charging infrastructure we may have customers who are unable to buy and use them.

30%

lower CO_2 target for 2030 than 2020

Jean-Bernard Lepage joined Faurecia as Clean Mobility Marketing Director in 2017.
He previously worked in marketing at Plastic Omnium, where he rose to the position of Global Marketing Director of its Inergy division. Earlier in his career, he held posts at Valeo, Ford and Bosch.

Is hydrogen the ideal alternative fuel for zero-emission vehicles?

Jean-Bernard Lepage: It has very interesting potential. At Faurecia, we consider that hydrogen fuel cell electric vehicles will complement battery electric vehicles (BEVs). They have certain advantages that make them more suitable for certain use cases. A fuel cell vehicle has up to 700 km of range, roughly double that of a BEV, and it can be refuelled in just three to four minutes, as against 20 minutes to fast-charge a BEV (or at least eight hours with normal charging). Hydrogen-fuelled electrical powertrains are zero-emission, of course, but the current conventional production of hydrogen is an energy-intensive process. However, the use of decarbonised hydrogen, produced through hydrolysis using electricity generated from renewables, gives hydrogen power a very good well-to-wheel ratio.

3-4 minutes

The time needed to refuel a fuel cell vehicle

What factors have to be overcome for hydrogen vehicles to become established?

J.-B.L.: Two roadblocks have to be overcome. One is the lack of availability of refuelling facilities. We need to see widespread development of infrastructure for trucks, buses and cars. Some countries, such as Japan, Germany and Switzerland, are much further advanced than others, including France. The vehicles now exist, but we are facing the second roadblock, which is cost. Faurecia is bringing down the cost of hydrogen tanks and fuel cell stacks by improving product design and manufacturing processes.
We are at the start of hydrogen mobility, and the issues of infrastructure and cost have to be solved. Having said that, hydrogen fuel cell vehicles are sure to develop over the next decade. I expect there will be a rise in volume by 2030, by which time hydrogen power will be more than a niche market.

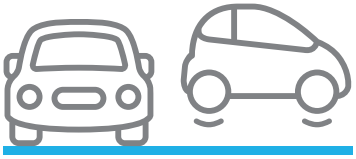
Jean-Luc Brossard is Head of R&D and Programme Director for Low Environment Footprint Vehicles at PFA.
Highly experienced in the industry, he has held senior posts in engineering and product development at Matra Automobile, Ferrari, Maserati and Pininfarina. Prior to his current appointment, he was Advanced Engineering and Innovation Director at PSA.

How do you see future trends in powertrains?

Jean-Luc Brossard: The chief trend in powertrains is electro-mobility. I'm thinking of electrified engines rather than full electric vehicles. At the level of Europe, we expect to see a market share by 2035 that will include up to 25% battery electric vehicles (BEVs) and perhaps 10% or 15% of plug-in electric vehicles, but up to 70% electrified engines.
Looking further ahead to the period between 2035 and, say, 2050, we are working on different alternatives that will enable us to meet the Paris Agreement targets set at COP 21. Hydrogen is a potential solution for the future, but we only forecast a 2% market share by 2035 because of the difficulties in the hydrogen ecosystem that have to be overcome: producing decarbonised hydrogen by electrolysis and transporting it to filling stations will be very expensive. Added to that is the cost of fuel cell components, which would prevent hydrogen vehicles being competitive.

If gasoline vehicles are still going to be on the road for many years, how can powertrains be improved to reduce fuel consumption and polluting emissions?

J.-L.B.: There are numerous action plans under way to find new solutions to improve the efficiency of the engine. A number of these are taking place in France under the aegis of a research association involving OEMs like Renault and PSA alongside major academic and research institutes. We are also working on reducing the weight of components. Reducing the weight of a vehicle by 100 kg cuts CO_2 emissions by four to six grams per kilometre. So introducing aluminium and composites for certain parts can play a big part, but we cannot lose sight of the cost implications. Not only do the new materials have to be competitive, they also have to perform their functions with at least the same level of efficiency.



4 to 6 g/km

Saving in CO_2 emissions for a reduction in vehicle weight of 100 kg

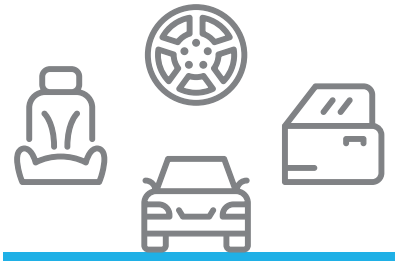
Gérard Liraut
has been Expert Leader on Polymers at the Renault Group since 2012,
working with a network of experts within Renault and Nissan-Mitsubishi. Since joining Renault in 1994, he has been a team manager specialising in tribology, cooling systems, fuel systems and steering components. Prior to his current post, he headed the Polymers and Fluids department.

How can smart composite materials help to reduce cars emissions?

Gérard Liraut: Replacing metallic parts with polymers already contributes to lightweighting, and reducing fuel consumption means lowering the level of polluting emissions. But as more and more electronic devices are incorporated into cars, electronic components such as actuators, sensors and screens as well as wiring are adding significantly to the weight of the vehicle. Smart composite materials do not only "feel" space, volume and surfaces, they are also capable of replacing the electronic components because they contain fibres that conduct electricity and signals.
To be optimistic, smart composite materials such as these should be in use in the automotive industry in five to ten years. First of all we will have to drastically reduce the cost of raw materials and manufacturing processes, though.

How significant a role will smart composite materials play in the future?

G.L.: Cars today contain roughly 20% polymer materials, and this level will probably rise to 30% within the next decade. About half of this content will perform smart functions. Alongside the increasing levels of electrification and connectivity that will occur, there will be an ever greater need to store and transmit data. This will have an impact on numerous functions, including comfort: smart fibres will be able to play a part in altering the configuration of the seats for different drivers and passengers, for instance, which will be particularly useful in the context of car-sharing.
These kind of functions will probably be very attractive commercially: they will become "must have" features with a strong "wow" factor. More importantly, they will allow cars to perform numerous advanced electronic functions without entailing additional weight.



30%

Proportion of polymer materials contained in cars by 2030

2 The inside story: creating an enjoyable in-car experience

Car interiors contain more and more electronic and mechatronic devices, and they perform increasingly sophisticated functions. Drivers and passengers already expect a lot from their experience in the cabin. When automated driving systems arrive in the near future, car interiors will be expected to perform even more functions.

Guillaume Devauchelle has been Vice President Innovation and Scientific Development at the Valeo Group for the last five years.
He had previously been the Group's R&D Director since 2004. He joined Valeo in 2000 following the purchase of Sylea company, where he had been an Executive Vice President.

What kind of new needs will car interiors have to satisfy in the future?

Guillaume Devauchelle: Carmakers today are primarily providers of mobility. In the future, cars will no longer be a means of getting from point A to point B in safety. As you sit inside one square metre full of electronics, what will matter to you is the services that the car offers. There is already greater diversity than ever in the equipment that is available, in small cars as much as in the higher segments, and this will increase even more with autonomous cars. There will be a completely new form of mobility. You will probably share your car, but when you get in, it will have a direct interaction with you – for instance, a personal camera will recognise you and the car will check on how you're feeling by responding to your breathing and stress levels, and provide the right lighting and music to suit your mood.

Will interior features like these add both weight and cost to cars?

G.D.: Features like these must entail no additional cost. Although people will be prepared to pay for services, no one can afford to pay more for cars than they do today. The industry will have to find ways of absorbing all the new features. Nor can the features add to the car's weight. Every new generation of cars has always been lighter than the last, and it's more urgent than ever that this continues. Mechatronics (which in simple terms is the integration of electronics in mechanical devices) means we can avoid using wires, shielding and so on and having to connect all the equipment to the car's central computer. Everything can be integrated much more simply and most cost-efficiently, and with the lowest possible noise and vibrations.

"Thanks to mechatronics, everything can be integrated much more simply and most cost-efficiently, and with the lowest possible noise and vibrations."

Guillaume Devauchelle

R&D is expensive. How do Tier 1 suppliers amortise it?

G.D.: By providing the technologies we develop to multiple OEMs. It would not be cost-effective otherwise. Ten years ago, Valeo had 6,000 engineers developing products, but today there are over three times as many. We have a technology incubator and a venture capital fund that invests in around 20 start-ups per month all around the world. While Tier 1 suppliers like us carry out technological research, the carmakers tend to focus their R&D on services – remember they are primarily mobility providers.

Dominique Manceau has been Director of Innovation of the Plastivaloire-Bourbon Group since 2015. He joined Plastivaloire in 1993 as a technician and subsequently became a Project Leader and Manager process engineering. He turned his attention to innovation in 2007, serving as Innovation Manager before being promoted to his current post.

What issues do noise and vibrations raise for plastic component manufacturers?

Dominique Manceau: With the advent of electrification, the lack of engine noise means that many other noises have become much more noticeable, such as road and tyre noise, dashboard vibrations, noise from air conduits and so on. When we design and produce plastic parts we aren't given specific targets to meet in terms of noise reduction, it's just a global demand. We carry out noise and vibration simulations on every project, and customers sometimes ask us for improvements. We used to mainly use high-modulus plastics to maximise the strength and resistance of our components, but now that sound-deadening has grown more important we also work with less rigid materials such as a polypropylene compound or a 2K moulding process to combine a rigid material with a soft material used locally as an anti-vibration material, like a styrene-ethylene-butylene-styrene (SEBS). We can also create a slight improvement by applying additives to current materials, so different solutions exist and are discussed with the car manufacturer during design studies. The choice of a material always means compromises over insulation properties, strength, aesthetics and cost.

Is lightweighting still a priority for plastic component manufacturers?

D.M.: Less than it was, say, two years ago. New European Union regulations have made lightweighting less important. Carmakers are on course to reach the lower emission levels in the small car segments. In the case of large premium cars, customers will simply pay more if the vehicle fails to comply with target levels. Some OEMs are still focusing on reducing weight in the premium sector, though. We recently developed an underbody cover in polypropylene with foaming technology for one of our clients. We also developed lighter material (with 25 to 30% density reduction) with ISO mechanical properties, but at the end of the day, the cost of the part was still more expensive.

How do you account for this change?

D.M.: The past two years have seen a very significant shift in terms of the development of hybrid vehicles and battery electric vehicles. Carmakers now see low-emission and zero-emission vehicles in the mix of cars on the road as the most effective way of achieving their overall emission targets, rather than reducing the weight of gasoline-powered vehicles, which was how they saw the situation previously. For plastic suppliers like us, this means that we now need to focus more on reducing the noise of our components than their weight.

Klaus Bischoff, Executive Director of Volkswagen Design, has been responsible for the Volkswagen brand's global automotive design since 2007. Since joining VW in 1989, he worked in a number of senior positions in interior design, exterior design and concept design. He took over as head of complete vehicle design in 2004.

What part do noise, vibrations and harshness play in car design?

Klaus Bischoff: We can't ignore them. When you design a car, you are trying to create something that gives the customer an experience and creates an emotion. If you achieve this through an outstanding shape and you make sure the customer feels great as he gets into the car, the effect will be totally destroyed if there are noises and vibrations as soon as he drives away. Sound is part of the promise of product quality and brand identity. Design is holistic and absolutely every detail counts, like every instrument in the sound of an orchestra. So our work is like that of a composer. As designers we are involved in everything.

"Designing a car is more than just creating an object. It is about providing the customer with an experience and inspiring emotions."

Klaus Bischoff

We create an experience, and try to exceed expectations, at every single touchpoint. Both the feel and the sound are vital!

Car interiors incorporate numerous sensors relating to safety and comfort functions. How are they integrated from a design standpoint?

K.B.: Engineers are always very keen to incorporate components and devices that will perform sophisticated functions. These kind of features often start by being

very large and obtrusive and end up being discreet and integrated into the design concept. At Volkswagen, we have 12,000 engineers and 400 designers. Engineers and designers seek the ideal compromise through an iterative process of negotiation. The engineers appreciate the fact that, as designers, our role is to create and uphold our brand identity. Designers and engineers respect each other's work. At Volkswagen, one part of our DNA is great precision in design, so in the end we are confident that the outcome will fully satisfy both the engineers, in terms of functionality, and the designers, in terms of the harmonious, simple and pure design.

How important a part does design play in car development?

K.B.: It defines the way the whole brand design looks and feels. As a design director I am a brand shaper, working on a total brand experience. Volkswagen design is likeable, sensual, innovative, logical and pure. In other words, our cars have friendly faces, they are harmonious, they try to be cutting-edge, they are logical (i.e. every instrument is where you would expect it to be) and they have perfect proportions. So design plays a crucial part in creating a new model.

3 Further down the line: what the future holds for car plants

Denis Hugelmann
was appointed Director of the Aeronautic, Automobile and Additive Manufacturing Division of the Fives Group in January 2018.
Having started out as a Laboratory Manager at the French Atomic Energy Commission in 1983, he held senior positions at Cogema, Arcelor and Areva. This is his second post in the Fives Group; he headed the Automobile Division in 2012-13.

Technologies that once seemed the stuff of science fiction are rapidly gaining ground in the automotive sector. Denis Hugelmann and Jan Leuridan, two highly experienced industry specialists from the Fives Group and Siemens, discuss the impact of 3D printing, robotics and artificial intelligence… and consider their impact on people.

What impact will 3D printing have on car manufacturing in the future?

Denis Hugelmann: At first, 3D printing was used only for prototyping, but it is now widely used for the production of parts in metal and in plastic composites. Additive manufacturing, the alternative name for the process, has two massive advantages compared to what we now call "subtractive" methods.
First of all, it means much more flexibility in the production process: 3D printing is single-step manufacturing, where several steps were needed to create a complex part with traditional methods. This has a significant economic impact, not only because you only use the quantity of material that you need, but also because there are fewer processes and machines, which corresponds to a significantly simplified supply chain and hence less investment.

€100 billion
will be invested by China in R&D on robotics by 2025

But the most crucial benefit is the design freedom that 3D printing allows, because you can produce parts that were impossible to produce before. Design can focus on the function of the part without being constrained by factoring in the technical feasibility of manufacturing it. This can lead to substantial performance improvements in cars: the shape of 3D printing-produced blades greatly improves turbine performance, for instance; it also makes it possible to reduce vehicle weight, which is a major issue for car makers.

"3D printing is a new revolution for industry. We now need more people in engineering offices to design with 3D printing in mind."
Denis Hugelmann

Jan Leuridan
is CEO of Siemens Industry Software NV, a post he has held since 2014.
He is the Senior Vice President in charge of Simulation and Test Solutions for Siemens PLM Software. Siemens acquired his previous company, LMS International, of which he was co-owner and Chief Technical Officer, in 2012.

Jan Leuridan: 3D printing will produce lighter components, and can sometimes even reduce the required number of parts. On top of that, it will be a game changer on the shop floor. A few years from now, 3D printers will actually be integrated into the production line, printing parts on the fly. These advantages on both product and production levels will result in enormous economic and environmental benefits.

D.H.: This is a new revolution for industry, for the automotive sector in particular. The only thing that is holding it back is people: in other words, we now need more people in engineering offices to design with 3D printing in mind. Young engineers are being trained to use it, the process is under way, but it will still be some time before their numbers reach a critical mass.

How do you see robotics developing?

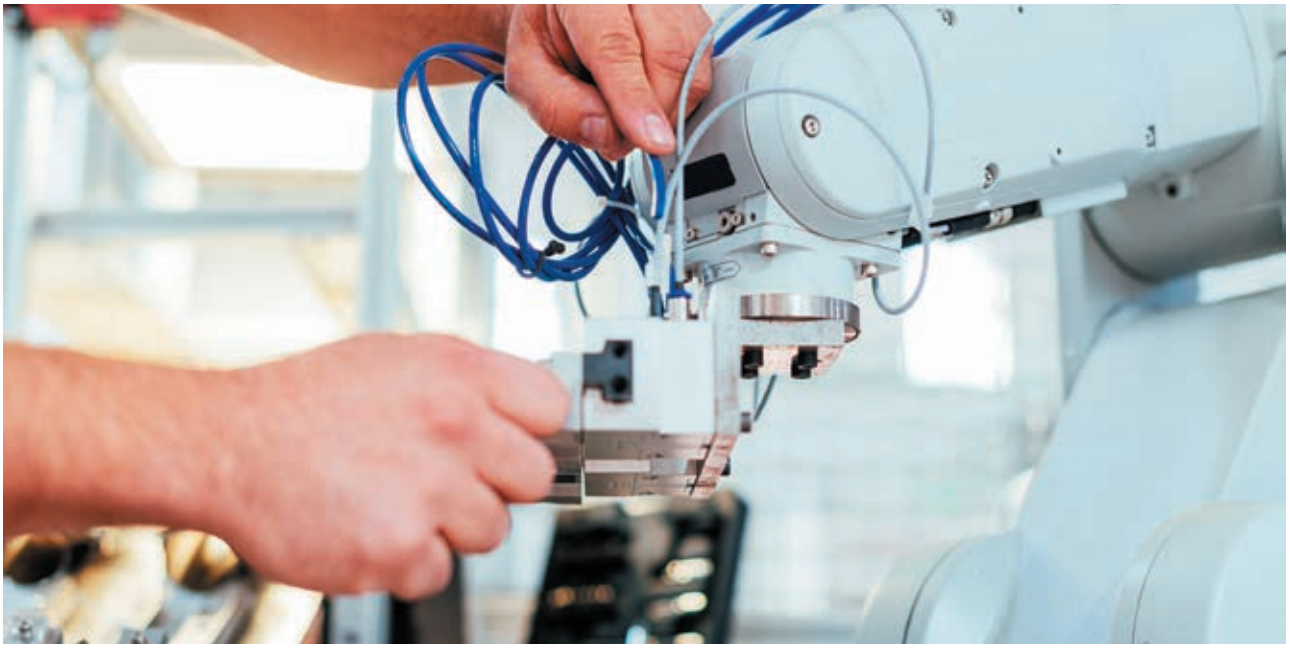
J.L.: Humans and robots will interact more closely. As a consequence, some precautions need to be taken to minimise safety risks on the shop floor. For now, robots are stationary and usually operate behind fences. But in future, they will be mobile, moving on autonomous platforms. To minimise risks to people and the environment, they have to be equipped with sensors and software.
At the same time, robots will become smarter and be capable of performing more complex tasks. Intelligent software will help them work more autonomously. You won't need to program them in detail any more for each individual task; instead you'll tell the robot its mission, and he will figure out how to do it.

D.H.: Robots operate within robotised cells. They will increasingly change the configuration of production facilities from the line to the job shop, as AGVs move production from one location to another.

J.L.: As the switch to electric vehicles is being fully accomplished, major changes will occur. OEMs will leverage the required refurbishing or addition of facilities as an opportunity to rethink their processes and make their plants future-proof. This will lead to a paradigm shift in terms of assembly methods, including a much higher degree of robotisation.
For many decades, the architecture of a car had not been changed dramatically. But this time it is different. Today's designs have many new components. Some models have about 80 computers on board for example, with very complex wiring and actuators. It will require new types of robotic programming methodologies to effectively assemble the electronics in the boxes that then go into the vehicles.

"Major changes in robotics will occur when OEMs have to refurbish existing facilities or construct new facilities as electric cars come into full production."

Jan Leuridan



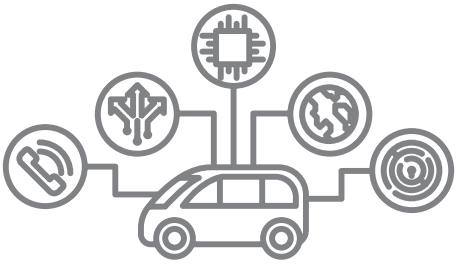
This requirement is widely recognised, even to the extent that some governments started to actively support and fund robotics R&D. China is a front runner in this respect, having pledged to invest over €100 billion in robotics by 2025. Bearing in mind that Chinese OEMs are introducing electric vehicles at a very fast pace, you can be sure such massive investment will result in new processes, perhaps even very soon.

How valuable will Artificial Intelligence (AI) be in the automotive industry?

D.H.: Enormously. With the use of very big machine tools in the industry, which can cause very expensive disruptions to production when they generate faulty parts, AI allows predictive maintenance through real-time performance analysis, meaning that you can repair the machines before they break down. The benefit for manufacturing efficiency and excellence is huge, and it will affect machine shops and assembly shops.

J.L.: Industry 4.0 and the Internet of Things have introduced a high level of connectivity, which is becoming part of daily reality in the manufacturing sector. In this context, AI can really bring huge advantages. For example when the AI brain of the production monitoring system detects that a machine will be going out of commission, it will be able to re-route production to avoid it encountering the malfunctioning machine.

D.H.: There are similar benefits for product quality and the detection of non-quality during the production run, of course. AI systems monitor production data closely and can spot quality issues before they occur on the basis of the weak signals they detect. It's a key part of the first time right approach to quality management.



80

on-board computers are integrated into some state-of-the-art cars

J.L.: Coming back to the robotics we were just discussing, AI makes both the robots and the AGVs more intelligent. In this matter, product engineering and manufacturing can greatly reinforce each other. The know-how that is going into autonomous driving vehicles could be brought to bear to greatly improve manufacturing efficiency, and vice versa.

What will the role of people be in the car plant of the future?

D.H.: Humans will remain at the centre of the production system. They always have been and always will be. But they are going to need to have totally different skills, knowledge and training.

"There has to be a tight connection between the education system and industry, to ensure we are giving people the right training."

Jan Leuridan

The end of the last century was already very different from what had gone before, and in the past 18 years things have already changed radically again. There has to be a tight connection between the education system and industry, to ensure we are giving people the right training. As I said earlier, I think this is most true of 3D printing.

Things are changing very quickly in so many ways. The technologies people will employ during their careers will change several times, and very quickly. But all the new technologies will be run by humans.

J.L.: It's clear that the technological progresses mentioned earlier will spectacularly change the daily environment of the car plant worker and alter the combined human skills it takes to produce a car. Some tasks will probably become less necessary, but at the same time, new ones should arise. This field of tension between man and machine is definitely not new. Every time technology causes an industry disruption, this question appears. It's a complex one, going further than the interests of individual companies, because it's directly related to the dual role the industry has in wider society. On the one hand, by becoming more efficient, companies contribute to economic growth. But at the same time, it's crucial that this efficiency gain happens in a human-centric manner. If not, the drive for profit could make the same economic system vulnerable, because at the end of the day, without jobs and decent salaries, people won't consume. In this context, individual companies need to show responsibility, and see themselves in the bigger picture. Together with governments, they continuously need to reflect on how to give shape to a sustainable economic landscape in which each individual human being can convert his or her innate talent into value.

Benoît Eynard is a Professor in Industrial Engineering at the Université de Technologie de Compiègne (UTC). He is a former Head of the Department of Mechanical Systems Engineering and Head of Innovation and Partnerships. He previously taught at the Université de Technologie de Troyes. He has published over 70 articles in international journals and 200 papers in conference proceedings.

Many of the engineers and managers of the car plants of tomorrow are students in technological universities today. What preparation are they given to handle the challenges of new technologies that they will face?

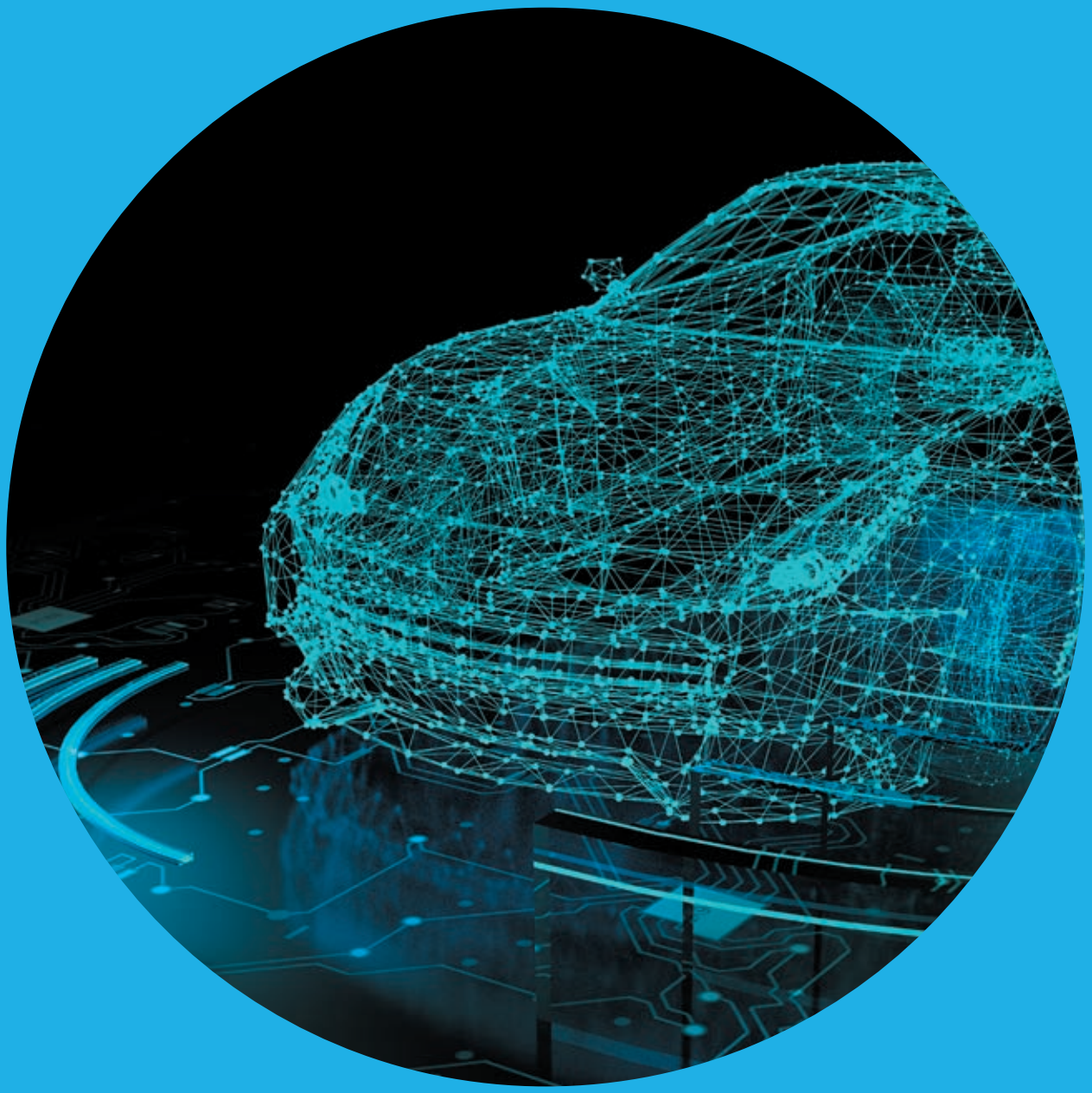
How do you prepare your students for the technological challenges they will face in the automotive industry of tomorrow?

Benoît Eynard: The young generation already have a digital way of thinking. 15 years ago, students found it hard to understand databases, for instance, but today if I explain that Google Drive uses database technology to share documents, they understand. They often arrive in industry and are surprised at how little connectivity there is compared to what they have in their own lives! We have to explain that they are the ones who will have to carry out the digital transformation. Supporting the transformation and managing change is more challenging than just integrating a new digital technology. I think the transformation will have occurred in the industry by 2025.

What about training the students for the more practical aspects of the plant of the future?

B.E.: We are currently experimenting in our teaching with what we call the Learning Factory. It's an industrial environment, a fully physical factory, inside the university. As well as machine tools, it includes robots, an autonomous transfer system, digital viewing of information, and so on. Depending on their specialisations, students spend between 40 and 100 hours per semester using the facility in small groups of ten to twelve. So alongside their theoretical courses, our students get an opportunity to learn by doing, which I think is what's needed when you're in the manufacturing environment.

4 Greater use of simulation in car testing

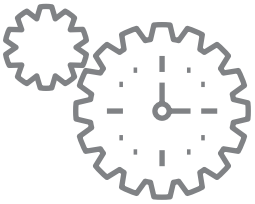


Pierre Jacquemot,
Head of the Vehicle Durability Test Bench Department at Renault since 2016,
is in charge of testing facilities for durability and reliability validation. He joined Renault in 2006 and has held a number of positions, including the management of a new line-up of products for China. He previously worked in product engineering at PSA Peugeot Citroën and Faurecia.

Simulation saves time and money for car manufacturers. Pierre Jacquemot, Head of the Vehicle Durability Test Bench Department at Renault, highlights for us the future of simulation in the vehicle development and validation process.

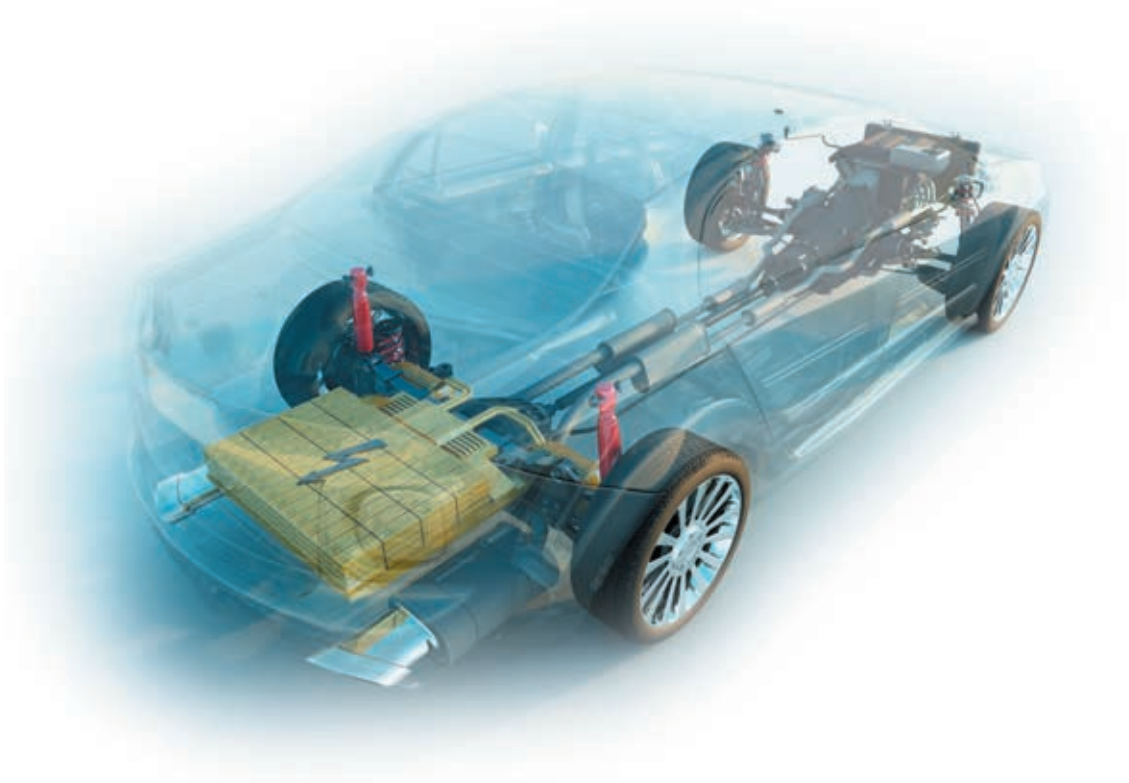
How important is simulation to Renault?

Pierre Jacquemot: We invested very heavily in simulations very early on. This allowed us to become more agile, shorten our development cycles and become more competitive. Even though we are particularly efficient in terms of time to market for volume models, we still carry out a lot of test-bench testing, of course – after all, we sell physical cars. Although calculation testing will never be used 100%, we optimise our physical work by incorporating increasingly complex digital data.



15 to 30%

Time saved in vehicle development by simulation



What are the uses and limitations of simulation?

P.J.: In some fields, such as passive safety, we have achieved a very high level of maturity, and simulations can now replace a lot of crash testing. The regulations still require validation by testing, certifying that a physical car behaves in a particular way.
At this stage, some kinds of simulations are still immature, durability among them, and it's faster to use test benches to validate multiple configurations.

What is the future of simulation in the validation process?

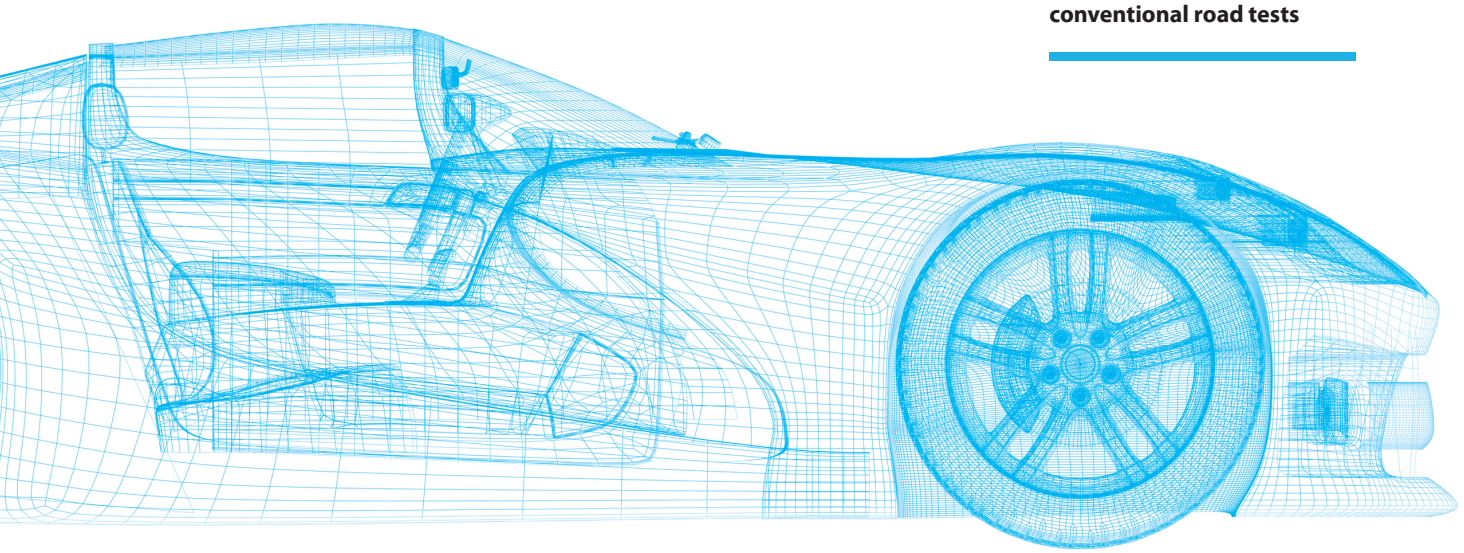
P.J.: We are making fast progress, and more and more forms of simulation will progressively come into use in the upstream phase before doing final testing, or by switching from physical Road Load Data Acquisition to simulated data in order to run the benches and test multiple situations.
Thanks to simulation, we can explore many more solutions in a very short time and decide which is the best to choose. This means that simulation and tests are not in competition but complement each other, allowing more robustness and efficiency in the development process.

"Simulation doesn't replace testing, but helps development. Without it there wouldn't be enough time to launch a car on the market efficiently."

Pierre Jacquemot

60%

Time saving in durability testing compared to conventional road tests



5 Cetim and the world automotive market

The global automotive market has altered greatly in recent years in terms of production and sales, and more radical changes lie ahead. What part does Cetim play in helping the industry keep pace with developments all around the world? Daniel Richet, Chief Executive Officer at Cetim, explains.

Daniel Richet
was appointed Chief Executive Officer at Cetim in January 2019.
He runs Cetim's international strategy and is responsible for its European R&D policy. Previously, he was CEO of Adepa (the French agency for the development of production engineering), following several posts as a development engineer in industry and as a consultant.

"The automobile industry in Europe will remain a major player because of its capacity for innovation, and it will benefit from access to production capacities beyond its boundaries."

Daniel Richet

What patterns and trends do you observe in the world automotive market?

Daniel Richet: The development of global demand is expected to reach 100 million vehicles. The momentum for electric vehicles is rising, with three million vehicles in China, the United States and Europe.
From a manufacturing point of view, profitability is back, with EBIT margins averaging around 6%; the debt burden is now lower than before the crisis.
R&D spending and technology acquisitions remain driven by Germany, the U.S. and Japan.
China is the leading country for M&A in digital technologies. The context of CO_2 and NO_X regulations and the revolution of uses, e.g. car sharing, are creating an irreversible trend for the next generation of vehicles.

How is Cetim positioned on these markets?

D.R.: Cetim is a word-class provider of services and technological expertise, from OEMs and Tier 1 companies to SMEs. Cetim has an innovative offer in lightering, with thermoplastic composites solutions, and it is developing new technologies for high pressure hydrogen storage and proposing multi-physical testing capabilities to meet the endurance and reliability challenges of new engines and power transmission subsystems.
Our focus markets are in regions such as Europe, North Africa and Asia, where the share of production is rising fast.

What future trends do you expect to see?

D.R.: The alternatives for engines remain open – HEV, PHEV or FCEV – but what is certain is that the key challenges around the world will be industrial, i.e. the introduction of new materials and new technologies to answer the challenges of regulations and new uses.
The market will also be sensitive to geopolitical developments, which are harder to predict.
The breakdown of jobs will be different, but the industry will continue to be a major source of employment: overall, one employee in car manufacturing will always generate two to three jobs in services.

Carnauto gives SMEs access to research

Carnauto, part of France's "Instituts Carnot" network of research facilities, helps small and medium-size enterprises benefit from leading-edge French research in the automotive and mobility sector. François Badin, Carnauto project manager at IFP Énergies Nouvelles, outlines the structure's aims.

François Badin
has been an Expert Director in Hybrid and Electric Vehicles at IFP Énergies Nouvelles (IFPEN) since 2008.
He is also a Carnauto project manager. Previously, he spent 22 years at INRETS (the former French national institute for transport and safety research), where he was a senior scientist specialising in hybrid vehicles in the Transport and Environment Lab.

What is Carnauto, and what purpose does it serve?

François Badin: The French National Research Agency, which funds a wide range of research projects, wanted to find mechanisms for extending its support to SMEs (small and medium-size enterprises) and improving connections between world-class research institutions and innovators working in small structures. It's the role of the Carnauto network to create the conditions where SMEs can increase their connections with labs and research institutes, exclusively in the automotive and mobility sector.

How does Carnauto support the automotive industry?

F.B.: We try to ensure that the products and services of French SMEs in the automotive sector contain more innovation. Our role is to facilitate their access to the results developed in our research institutions. Carnauto is not a research project as such; we develop the phases that precede the project itself. We listen carefully to the ideas of French SMEs, determine with them how they can resolve the problems they are facing, and help them find the most suitable facility to work with (many of which are not widely known). We bring the parties together, help set up a research project, and then leave them to get on with bilateral contracting!

How does Carnauto view the automotive industry of the future?

F.B.: The vehicles of the future will be connected, autonomous, shared and electric – what we call the C.A.S.E. concept. The whole concept of mobility will be turned on its head. Our children won't necessarily own cars; they will purchase mobility as a service (M.A.A.S.) much more, in whatever form corresponds to their needs at any given moment. In this context, there will probably be major changes in the automotive value chain, with a possible greater pressure on technology providers, for instance. It's an environment in which we expect innovative SMEs to be key players, and Carnauto will have a decisive role to play.

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Cetim has been awarded the Carnot Institute label and is a member of the CTI network and the Industry of the Alliance Industrie du Futur.

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