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# THE AUTOMOTIVE INDUSTRY IN A NEW TEHNOLOGICAL ERA

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**Abstract**

*The business world is changing at an impressive speed: the global financial crisis, challenging markets, technology and talent crisis have a major impact on business. The last century can be associated with the triumph of the automobile industry. At the beginning of the 21st century the automotive industry has experienced one of the largest shifts in the automotive history. The new $CO_2$ regulations on global level have determined the automotove industry to adopt new and original technologies faster than anticipated. The emerging tendency of car sharing in larger cities added to the media information related to the negative environmental effects of car mobility generate concerns that customers were seeking a replacement to the traditional, individual car ownership. The automotive industry will face challenging years ahead taking into consideration the shifting paradigm in auto-mobility. In this context, this article aims to provide a general perspective of the tendencies in the automotive sector.*

**1. Introduction: Automotive tendencies**

There are many key trends which will impact automotive manufacturers, wholesalers, retailers, customers and drivers over the next years. According to KPMG's 2014 Global Automotive Executive Survey, the rising economic power of the emerging markets (especially the so called BRIC states – Brazil, Russia, India and China) remains the central growth force for the next 10 years, the industry become more global and automakers are obliged to use flexible, modular platforms in order to adapt to the new, changing preferences of the customers and to find resources to invest in powertrain technology imposed by global environmental regulations. In the same time, the macro-scale factors responsible for the success of the automobile industry in the traditional, developed countries are moving now in the opposite direction. A socio-technical transition perspective stresses how declining industrial influence, stagnating wages together with a changing demographic landscape are influencing the automotive industry. The Figure No.1 referes to the percentage of respondents of the study that rated a trend as "extremely important" or "very important" :

If we want to analyze potential future trends, we can observe the roadmaps of some of the OEM's (Original Equipment Manufactureres). The Figure No.2 below shows the social economic drivers and technology roadmap of Daimler.

**2. Global developments influencing the automotive industry**

The automotive industry is adapting to the new fast-changing competitive landscape. CO2 emissions are a major concern due to the important pollution, combined with rising fuel prices determine that ICE downsizing is becoming a higher priority as electric battery technology has so far failed to offer a reasonable cost-effective alternative. Digitalization has a powerful impact on the vehicles, these becoming more dependent upon software. Silicon Valley Innovation will dominate every industry. Self-driving cars become a probability. The impact of this trend is that it will also shift control from any particular industry – insurance, healthcare, banking, automotive — to the technology companies. Also the manufacturing techniques are in a rapid change process. Modularization and platform technology reduce the cost and time of assembly, rolling out models that reflect also changing customer needs and tastes. What will be the future of retail? Dealers are trying to transform their business models to manage the transition to online buying and to find opportunities where they can build margins. Urbanization determines changes in the road infrastructure and influences not only the dimensions of new vehicles but a new perspective o car ownership. Mobility as a service is a reality. The BRIC states include a larger part of global market and the decision makers in the automotive field are searching ways to expand the new strategic partnerships. In Figure No.3 we can observe the global developments faced by automotive industry:

The future belongs to those who are fast. Tech companies and tech based innovators are the winners! And the key issue is speed! Apple, for example, could innovate much faster with new credit card financial systems than any bank could. Google and the tests of automatic car navigation technology will certainly evolve faster than any auto company in Detroit, Japan or Germany could. Leaders in those organizations will learn to focus on speed as a metric, and fast-innovation as a core capability.

**3. Technology**

The current engine and transmission line up is changing rapidly: hybridization, electrification, downsizing, down speeding are just a couple of technology paths being introduced in the last decade. This leads to parallel development of used technologies. The problem with this multiple engineering tracks is that it is straining resources at the OEM's and suppliers. The economic crisis that struck the world in 2008 and from which we are slowly recovering, did not help the financial situation in the automotive industry either. It is expected that this **differentiation** will continue for the next decade. One primary driver for the increase in development and differentiation in the powertrain area is legislation. Both in the truck industry and the passenger car industry technical challenges are driven by legislation: legislation in emissions of hydrocarbons (THC), Carbon monoxide (CO), Carbon dioxide (CO2 = linked to fuel consumption) and Nitro oxides (NOx) and Particular Mass (Pm) being either voluntary or enforced are pushing the technology envelop.

In the chart below we can observe that the competition to produce cleaner, more efficient vehicles have taken another turn, as optimization of the traditional **ICE** remains the clear priority for automotive companies, BRIC OEMs (Original Equipment Manufacturers) are more determined to invest in alternate power technologies than their TRIAD (USA, Canada, Mexico, Europe, Asia Pacific) counterparts.

Areas for technology investment in the next years can be seen in the Figure No.4.

In conclusion, it is an important difference between TRIAD and BRIC OEMs: the former intend to invest in ICE downsizing, whereas the latter are oriented versus various forms of e-mobility – plug –in hybrids and pure battery electrified vehicles. The BRIC OEMs have a more balanced portfolio, planning to invest across all e –technologies. This trend could signal a shift in technological

leadership. Plug-in hybrids are forecast to be the leading e-car, with fuel cell-powered models growing in popularity.

**Materials production** can aid the energy-efficiency of vehicles. Lightweight materials will be available for mass market production within 5 - 10 years, with models such as Audi e-tron leading the way.

BMW just started the production of the carbon-fiber-bodied i3—a vehicle that makes some major advances in the way lightweight, mass-produced vehicles will be made. For Audi, which was a leader in the development of aluminum-bodied cars 20 years ago with the original Audi A8, the future will follow a more diversified approach, according to Dr. Ulrich Hackenberg, the Audi AG board member in charge of technical development "To make an area of a car in carbon fiber is very expensive. We are looking at the cost aspects and the aspects of strength as a starting point."Hinting at what materials we're likely to see in future Audi models to reduce weight, Hackenberg explained that flexibility is crucial and that using different materials in different places in a car might be the way to do it. For instance, high-strength steel could provide safety protection around the A-pillar, while an aluminum space frame could underpin the vehicle and surfaces could be done in laminated steel, plastics, or carbon fiber. The next step, he says, may be working on the methods of efficiently welding composites to aluminum and steel, or adding inserts such that plastic or carbon fiber might be welded against steel. "I think you need the right material at the right place in the car, and the challenge is how to bring it together," said Hackenberg. "You need different machinery, different robots, and everything to do that," like it is pointed out in the Figure No. 5.

Reports from earlier in the year suggest that the next-generation Audi Q7 due next year might be employing some of those techniques. The process with the slowest speed is defining the frequency of production, Hackenberg explained, so the solution is to bring in production methods that allow lighter materials to be used selectively in combination with others that can keep costs down. So even if the cost and strength aspects and benefits of such a hybrid structure look great for a lighter-weight vehicle, the rest of the manufacturing realities would need to make sense as well.

**Electric vehicles** are one of the most important ways to reduce motoring costs, reduce carbon use in transport, improve air quality and reduce global warming. Battery-powered vehicles are estimated to reach 10% of the market by 2020. Models like Nissan's Leaf and Chevrolet's Volt have led the way. Electric cars can produce much lower emissions than burning fuel in mobile engines, but it all depends on how the electricity is generated. Burning petrol or diesel in a small, mobile engine can be inefficient compared to the most efficient coal-fired power generators. When petrol is used to power a vehicle, only 15-20% of the energy is usually captured to drive the car forward, compared to 40% in making electricity in an efficient coal power station. A small amount of power is lost between power station and battery, and 20% of electricity put into the car is lost in heat (batteries and other components). But even when we include these things, we can see that "coal-powered" electric cars are likely to be better users of fossil fuels than diesel or petrol vehicles. Where wind, solar, waves, tide or nuclear power is used to charge batteries, electric cars have zero emissions.

Air quality improves dramatically in cities as the use of electric vehicles increases. Owners can also save a huge amount of vehicle tax on petrol or diesel since taxation is far lower on electricity. If half a million people are driving electric cars across a nation, oil consumption will fall dramatically, while coal or gas power consumption will rise in the short term.

Batteries are going to be one of the biggest green tech businesses – powering not only phones and other small devices, but also cars, trucks, buses and just about any large piece of equipment that does not have a permanent electricity connection. This means expected sales of hundreds of billions Euro. Many governments will give important incentives to people who want to buy electric cars. Israel and Denmark are leading the way.

**Hydrogen and Fuel Cells** are an answer to battery problems? Many specialists in the industry are talking about the so-called hydrogen economy or water-powered cars. Making hydrogen requires electricity to split water into hydrogen and oxygen, and in an area where most power comes from coal, these hydrogen cars are running on coal power.

It is difficult to store and transport hydrogen. It is a very "thin" gas which seeps through microscopic cracks, so gas can be lost when piped under pressure over long distances. Total energy per cubic litre (liquid hydrogen) is less than carbon-based liquid fuels, so tanks also have to be larger. Filling a normal sized fuel tank of 75 litres (20 US gallons) with hydrogen at room temperature and pressure will only take a car 1 kilometre. Hydrogen could be used in fuel cells, which make electricity at the same time as making water from hydrogen and oxygen. Less heat is lost than burning hydrogen, but they cost thousands of dollars per kilowatt hour to build.

For all these reasons, it seems unlikely that tomorrow's global auto industry is going to switch to hydrogen soon.

According to KPMG's report, in the near future, **plug-in hybrids** are forecasted to be the most attractive solution of e-vehicles. Many premium OEMs decided to introduce hybrid engines in higher-end models (Mercedes S500, BMWi8,

Lexus CT200h and GS450h) which signals an image transformation away from the more utilitarian look of most hybrids.
When we think of hybrid vehicles, we have in mind great fuel economy and limited performance. So the phrase "high-performance hybrids" may seem senseless. But cars like Porsche's Panamera E-Hybrid, the Audi R8 e-Tron, and the Tesla Model S offer high-performance driving fun combined with the benefits of an electric vehicle. This latest trend in hybrids offers consumers the performance they desire and still allows drivers to be environmentally friendly. The hybrid's inherent complexity, and the fact and some of the best storage and conversion systems have yet to be fully developed is responsible for the varied opinions on a hybrid's energy efficiency, environmental benefits, and manufacturing costs. In addition to technical capability, enormous economic challenges also have to be overcome in order to produce a refined hybrid vehicle. Greening of the world car fleet is happening fast. JD Power Consultancy estimates that a third of emission cuts by 2020 will come from improving petrol and diesel engines, and 14% from miles driven in electric vehicles.

**4.Urbanization**

The global population is expected to increase by 38%, from 6.9 billion in 2010 to 9.6 billion in 2050.
In North America and Western Europe, the growth in automobile population is roughly equivalent to the growth in human population. But in the developing world, growth is almost exponential because of expanding economic growth. Cities will become more congested. In this context, traditional patterns of vehicle ownership are likely to change dramatically. This trend calls for wide scale mobility solutions in urban centers. The "millennial" generation of young adults appears less interested in traditional purchases (house or car) preferring alternatives such as mobile devices and clothes. The challenge for the main automobile producers is to come up with a new way to meet these needs. Mobility as a service is an idea that arrived via services such as car sharing or wider solutions regarding multiple modes of transport booked over a single provider. To evaluate the question of the mobility of the future, KPMG conducted a large market survey, focusing on the current and expected mobility needs and preferences in different countries. In the Figure :
When we look at the entire picture**,** there are compelling reasons for a switch to more efficient transportation technologies. The economic ramifications of mounting environmental problems, changing weather patterns, and future monopolies and instability in energy supplies could be enough to threaten the very foundations of our industrialized societies. It's in our own interests to create a more energy efficient and sustainable system.

**5. Connectivity**

The connected car is one of the fastest growing technological devices after phones and tablets. As cars become more connected, manufacturers, dealers, technology companies etc are gathering an enormous amount of data / information on users. How these "big data" will be used could determine their success in building brand loyalty and generating income. As more as software becomes embedded in vehicles, the self-driving car becomes more and more a real possibility. With the onset of new technologies like blind-spot detection, lane change departure, backup camera sensors, cross traffic alerts, active cruise control, and many other exciting innovations that allow you to be safer on the road, you're almost halfway there. Having someone else (even a robot) drive your car may not be a good fit for everyone, but consumers do want computers to help be safer on the road. Most manufacturers are stating that you won't see totally autonomous vehicles on the road until 2020.
There are many hurdles to clear, including government regulations, consumer acceptance and legal issues. The announcement in October 2013 of Japanese electric motor manufacturer Nidec regarding the acquisition of a subsidiary of Honda, bring out the growing influence of electronic companies in the automotive market. Also Panasonic highlighted the intention to double its automotive business by 2018. As the computerization of the cars accelerates, there is to observe also increasingly moving in electronic devices, to the extent that almost half the cost of a hybrid vehicle goes on electronic parts. If drivers-free cars will be a reality, then many other conditions should be achieved. In this context, the relevant stakeholders need to make huge investments in vehicles –to –internet communication, additionally to cost effective sensors and radar based options. For such a transformation, the industry has to concert all their resources.
In Figure No.9 we find the results of a survey made by the University of Baltimore in 2013, where the most desired applications by customers were identified.
The customers want to take the entire digital world on the road, in the car. The latest infotainment products support human machine interface, information systems, diagnostics, entertainment and connectivity to meet the growing demand for in-vehicle interaction. We assist actually to a revolution on the roads.

## 6. Conclusions

Ongoing changes in the global automotive industry are profound, determining the production of energy-efficient vehicles that meet the requirements of megacities and embrace the technological evolution and revolution. The rapid growth of the emergent states adds fantastic opportunities but, in the same time, intensifies the competition. The duration and size of this change is uncertain at the moment.

The automotive manufacturers will gradually lose their dominance in motor expertise, as suppliers take a more involved role in the process. The OEM will become pure mobility solution providers in order to satisfy evolving patterns of car ownership. Daimler's car2go mobility concept is an example of this direction, where drivers can hire a car instantly from a range of cities in Europe and USA. The participants can locate available cars online and use the car as long as they want, leaving it then in any public parking space in the city zone.

New entrants from sectors such as technology or utilities are likely to become important players in the automotive industry.

The actual trends, the new efficient, environmental friendly, smart and connected e-vehicles, all the changes impacting the automotive industry will have a major influence also on the skills of the workforce employed in the industry at all levels. The training curriculums in the industry will change. Older functions and activities will disappear. New competences and abilities should be developed to accompany the evolutionary tendencies in order to ensure the technological survival of the automotive actors.

People being the core resource in the development of any business and a long term performance of any company impose a complete and comprehensive plan, well structured and framed in time and space, containing the implementation methodology and especially the competent resources, managers must undergo certain steps to successfully coordinate teams and business in the new global context.

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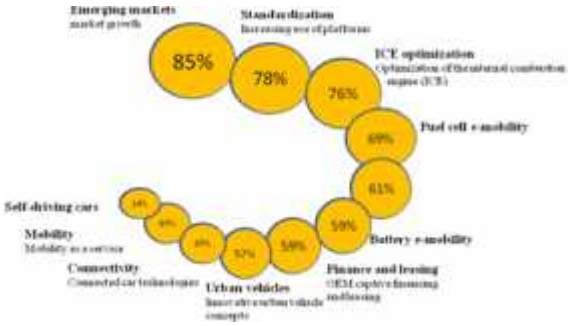
*Figure No.1* Automotive trends up to 2025




*Source*: Adaptation on KPMG's Global Automotive Executive Survey 2014

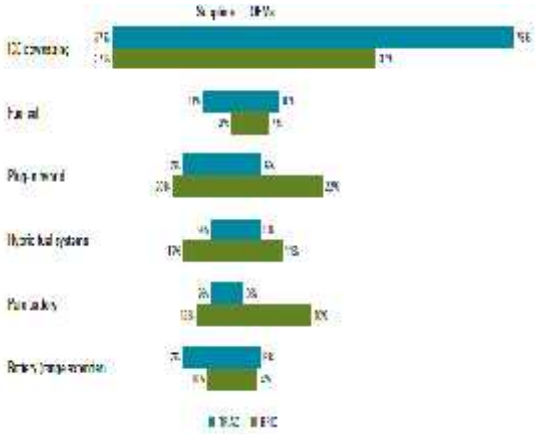
*Figure No.2* Daimler's Technology Portfolio


*Source:* Mercedes-Benz, International Website

*Figure No. 3* Global developments


*Source:* Adaptation on KPMG's Global Automotive Executive Survey 2014

*Figure No.4* Areas for technology development

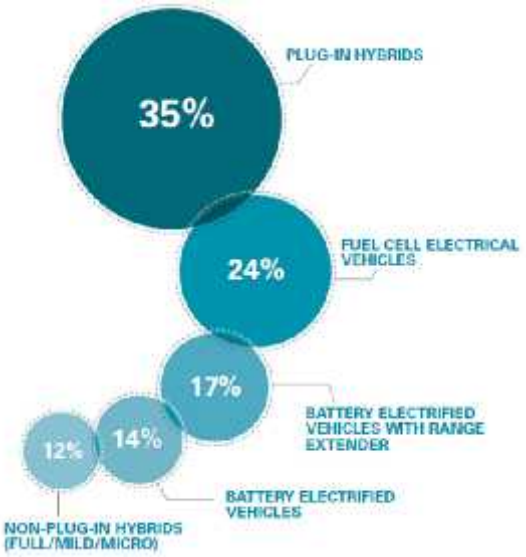


*Source:* KPMG's Global Automotive Executive Survey 2014

*Figure No.5* Material mix for the future vehicules

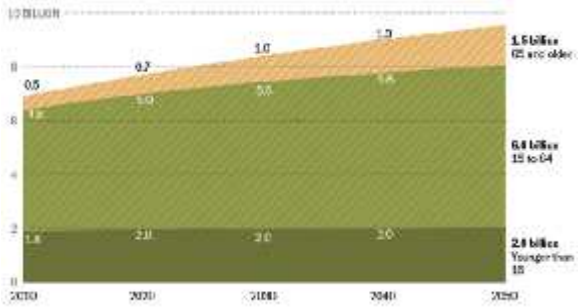
*Source:* Organisation Internationale des Constructeurs d'Automobiles

*Figure No.6* Electric vehicle technology attracting the most consumer demand by 2019




*Source:* KPMG's Global Automotive Executive Survey 2014

*Figure No. 7* Estimated population by age, 2010 – 2050




*Source:*United Nations, Department of Economic and Social Affairs, World Population Prospects, June 2013

*Figure N. 8* Expected share of new light vehicule registrations by 2025


*Source*: Adaptation on KPMG's Global Automobile Executive Survey 2014

*Figure No.9* Desired applications on car