INNOVATIVE TRENDS IN THE AUTOMOTIVE INDUSTRY

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Abstract
The paper deals with the drivers of changes in the automotive industry over the next decade. Defined as major trends: changes in customer demand in global markets, innovation, and product design, technology for lean and agile manufacturing and supply chain development. Emphasizes innovation based on new materials, a wider application platforms, electrical mobility and communication technologies. It represents the implementation of selected horizons of innovation.

Key words: Automotive industry, cars and production systems innovation

INTRODUCTION
The current innovative trends cars are well known. [1], [2] type of going innovation, continuous improvement in the parameters: a high utilization of the space vehicle, the variability model, the utility value - performance, reliability, fuel consumption and others. Innovation support to provide specific new materials, electronics and design optimization using computer-based support.

Expansion is the emergence of innovation in support of active and passive safety car: antilock braking system, electronic stability, electronic brake-force distribution, emergency braking system assistantship, variants airbags, crumple zone body strength and stiffness components, sensors for advising and other risks.

Then there are environmental oriented innovations which are affecting the reduction of fuel consumption, reduce automobile emissions and recyclability at the end of life, digitalization of vehicles observed in new equipment - navigation systems, communication via the Internet and called. Intelligent elements (automatically responsive to changes) and telematics - the use of the principle of satellite navigation for localization, path planning, connection to communication networks, control speed and distance, calling for help in emergencies and others.

The automotive industry continues to face environmental problems, increasing urbanization and changes in consumer behaviour. It calls for a radical new approach to future mobility. According to the 2012 KPMG study starts changing nature of global mobility. Major trends according to this study are [10]:

- Given the growing pressures on fuel consumption as the most pressing trend in the automotive industry is considered to electric mobility.
- The increasing urbanization, city dwellers in need of cars suited to their particular environment. Urban-oriented design is an important trend for the future of the automotive industry. Cities are trying to reduce pollution and congestion and replace car ownership by car sharing.
- The growing importance of the financing and leasing of cars, especially in emerging markets.
- Connected car concepts are also on the agenda of automobile. More and more vehicles will continuously communicate with the real and virtual world. This trend should accelerate mobility and in particular to reduce accidents.

THE FUTURE OF CAR ENGINES
Experts agree that despite the final irreversible return of electric vehicles on the scene will be at least in the next decades dominated by gasoline and diesel combustion engines. In many cases, work with electric motors, whether in the form of hybrid, or will act as a generator of electricity. [3], [4].

Electric vehicles are not new. They are even older than cars running on petrol. The first electric vehicle appeared on the road in 1873, gasoline-powered motor vehicle on a road and discovered about twelve years later.

Hybrid cars have appeared much later. Japan gave the authorization for testing hybrid vehicles with plug-in on the public roads in 2006. Then the Toyota Motor Corporation announced that it has developed a car with a Prius hybrid to allow charging directly from the mains.

The current World Motor Show between innovations and concepts cars nearly equal proportion of cars with internal combustion engines and hybrids and electric vehicles. The situation in the automobile market is much different. Prognosis in Fig. 1 shows that even the most developed in the U.S. automotive market will be 20 to 40 years dominated by internal combustion engines.

The slow market penetration of hybrids and electric vehicles has two causes:

- Low energy density batteries. For example, the advanced lithium-ion batteries have an energy density of only 100 Wh / kg, which is 30 times less energy.
than gasoline - 3000Wh/kg. The obstacle is the high cost of batteries.

- The second reason is the competition for internal combustion engines of innovation. According to studies, can increase the efficiency of combustion engines to reach 30% by 2020 and up to 50% by 2030 (FIA Foundation, "50 to 50: Global Fuel Economy Initiative").

Experts agree that the future of cars is based on the sequence [11]:

- Increased efficiency of combustion engines - Hybrid technology - electric cars.
- Appendix - increasing the share of alternative fuels.
- The hydrogen technology as the future of sustainable mobility.
- Electro mobility condition is that the electricity must be provided from renewable sources. This is the only way to ensure sustainability.

The findings from this year’s survey suggest that future success is based on a number of key levers:

**Electro mobility** will be a central part of future power train design across both developed and emerging markets, with great potential in the BRICs and especially in China. The biggest challenge will be to identify the most promising technology. According to the survey, fuel cell technology has not yet realized its full potential, although Daimler, Hyundai/Kia, Toyota and GM are already very active in this area.

**Innovative urban mobility concepts**
The industry has to move from vehicle-oriented to human-oriented urban design and mobility concepts. Among the more progressive OEMs are Volkswagen with its car-sharing concept Quicar and the Audi Urban Future Initiative. BMW also

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![Fig. 1 Forecast of U.S. car sales by technology](image1)

**Fig. 1** Forecast of U.S. car sales by technology [2]

![Fig. 2 Share of annual new e- vehicle registration by 2026 KPMG](image2)

**Fig. 2** Share of annual new e- vehicle registration by 2026 KPMG [1]
combines car sharing and urban design with Drive Now and its sub-brand BMWi.

**Connected car solutions** It is becoming increasingly important to connect the driver, the car and the environment to make driving more comfortable and safer. To be effective, this technology needs a large take-up, so it may soon be available in most new cars.

**Service-orientation & e-financing solutions** Besides more service-orientation there is likely to be a surge in innovative financing offerings, particularly for e-components, with huge potential in emerging countries.

**Cooperation and alliances** Manufacturers cannot manage everything alone. Many advances in technology and services have flowed from other industries. For example, the mobility services concept is very different from the traditional OEM model. Collaboration is the obvious way to manage such change and brings a number of additional benefits, including joint R&D spending, access to new technologies and products, new business models and the potential to pool risk and investments.

**Growing strength of the emerging markets** In BAIC, SAIC, Chery and Geely, China provides four of the top ten predicted fastest growing automotive companies, reflecting the country’s enormous importance. Chinese automakers have already started to grow overseas, which will intensify competition in established markets.

**The lingering shadow of overcapacity and excess production** Have to address excess production seriously. The BRIC markets already have immense overcapacity and could also be heading for excess production as a result of growing production volumes in other markets. Manufacturers have to get the right level of capacity to cope with up- and downswings in demand.

**Trends For The Automotive Future in the U.S.** [4]

**Probable Trends**
- 2015: vehicle-to-vehicle communication for safety functions
- 2017: 6% of all vehicles worldwide will have Internet access
- 2020: plug-in capability standard in about 10% of all new vehicles
- 2025: vehicles in part actively controlled by roadside infrastructure
- 2035: still more than 50% of all new vehicles have combustion engine

**Possible Trends**
- 2020: car-sharing membership increases 3% of all people who use a car
- 2030: electric vehicles more than 20% of all new cars
- 2030: electric systems replacing all mechanic chassis systems in new vehicles

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**Fig. 3** The most important trends in the industry in the next 15 years

Source: KPMG’s 2012 Global Auto Executive Survey
Plausible Trends
2030: fully autonomous driving, driver out of the loop
2035: hydrogen as transportation fuel for 5% of all new vehicles

Moving automobile R & D
According to a study Foresight Vehicle Technology Roadmap [6] further innovation will be determined following car line:

The development of engines and propulsion technologies
- Improving the combustion process: adaptive calibration, operation without cylinder cam, variable compression, alternative fuel cycles and improved systems.
- Optimization of drive systems: systems that use waste heat, innovations in gear, size reduction, intelligent support systems, catalysts with reduced dependence on precious metals, reducing the size of drives.
- Minimal maintenance: sensors, wear compensation management, integrated diagnostic systems, modeling and prediction of failures.
- Improved lubricants, additives and filtration, coatings, materials, bearings, corrosion inhibition and resistance to mechanical violation, improved sealing and storage.

Construction and Materials
- Design techniques for the simulation of a shock to the variable design based on virtual technology.
- Smart materials increasing safety: passive and active materials in combination with control systems.
- Reconfigurability of the vehicle: to ensure structural integrity, modular structure, and high-strength platform.

Technology of production
- Reduction in costs over the life cycle and environmental impact and reduce operating and maintenance costs.
- Development and processing of new materials: materials with the ability to shape memory materials with improved properties (mass, stiffness, energy absorption), pre-treated with durable materials without the need for coating, manufactured by injection moulding at low pressure and the casting new composite materials.
- Innovation in materials joining technologies without affecting the material properties, preservation coating materials during the process and production without damaging, staining system integrated into the tool, reconfigurable moulding, injection molding, casting and other technologies.

Design and manufacturing process
- Significant reduction in the design process of components and production preparation time by using new methods: Rapid Prototyping, Rapid Tooling.
- Implementation of additional design changes to production without increasing costs, reducing cost of production tools.
- High-tech manufacturing processes and technology components, assembly and testing, user support and methods of recycling and regeneration.

Integrated production
- Reduction in solid waste volumes, approaching zero, the development of recycling technologies, the possibilities for reuse of waste materials in manufacturing and energy production, sustainable production: reducing consumption of materials, energy and waste in the manufacturing process.

Low-cost production increasing flexibility: increasing reconfigurability,
- Electronic data interchange in the design, analysis, manufacturing, testing and operation, allowing an increase in quality, competitiveness and customer orientation, standardization of virtual reality.
- The transfer of innovation, particularly in aerospace and military industry, system integration product-process-knowledge, information security, intellectual property protection.

Highly efficient production
- Flexible adaptable production equipment and systems ready for rapid reconfiguration and optimal use of energy.
- New hybrid production systems for manufacturing, assembly and disassembly, based on robotics and automation technology for optimisation of tasks between humans and robots.
- New technologies, high performance in terms of production efficiency (volume, speed processes), durability and accuracy. The new system architecture with construction machinery adaptively based on mechatronic modules, multilayer and high efficient control measure.
- Adaptive equipment and production systems for optimal energy consumption. Flexible adaptation of energy for high performance machinery drives.
High-precision micro-manufacturing machines and systems
- Production of 3D micro parts with a wide range of materials (metal alloys, composites, polymers, ceramics) and in large volumes. The new process chain integration of different technologies. Analysis of behaviour of materials and their interaction with the production process. Quality issues for micro components, measuring tools and equipment, handling equipment and systems,
- Micro factory and micro-manufacturing systems. Easily configurable assembly lines located in a small space for installation and testing of small components, devices, sensors, actuators, etc.). A new generation of modular macro, meson and micro machine tools and robots, allowing the adaptation and reconfigurability. Options for the introduction of portable and easily configurable factory for manufacture and assembly of miniature high-tech equipment. Development of control systems for monitoring and reconfiguration of manufacturing systems and quality assurance for microsystems.

CONCLUSION

Foresight analysis for the next decade of innovation car can be summarized as follows [3], [7], [8].
- Sophisticated consumers. Consumers in 2020 will be very well informed and will have a new, radically different preferences. Information will allow for greater transparency throughout the chain of creation, production and use of cars.
- Intelligent vehicle. Today, automotive innovations require different configurations of cars, increase performance, reliability, security, economics, etc. Vehicles in the near future will compete in “intelligence”.
- Dynamic operation. In 2020, the complex will require innovative approaches in technology, human resources development and environmental issues. The newly defined business strategy will be extended to active flexibility and agility.
- Integrated business. It will seek to meet the sophisticated consumer, develop and produce intelligent vehicles in their transition to dynamic sites. There will be new identity
- Ecosystem. Consumers, regulatory and environmental requirements are forcing the automotive industry to expand into new dimensions, which representatives of the electrical mobility.

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Acknowledgments: This contribution is the result of the project implementation: Centre for research of control of technical, environmental and human risks for permanent development of production and products in mechanical engineering (ITMS: 26220120060) supported by the Research & Development Operational Programme funded by the ERDF.