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Tailor-made Technology: The stretch of Frugal Innovation in the Truck Industry

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Abstract

At first the current situation of the vehicle industry and the tremendous influence of digitalization technologies for the value chain structure are described. The second part of this paper describes demand side aspects. It becomes clear, that emerging markets have a promising sales potential for trucks in the future. When the described technology developments are brought together with the results of the demand side analysis, it becomes obvious, that there is an increasing gap between the products developed within Europe and the U. S. and the needs of customers within developed and emerging countries. There is a need for frugal innovation and the realization within a comprehensive lifecycle approach to tackle these challenges.

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Keywords: Innovation management; Automation; Economics

1. Challenges and opportunities for the digital vehicle industry

The European vehicle industry (cars, busses, trucks etc.) is currently facing an extremely dynamic and potentially disruptive era. Enabled by sophisticated IT-technologies completely new business models come into reach and will sustainable restructure the vehicle value chain as we know it. Recent developments indicate e.g. an end of the

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traditional car ownership concept and the introduction of a new area of mobility service providers [1]. This rapid and vital development is mainly driven by digitalization trends resulting for the automotive industry e.g. in the evolution of Advanced Driver Assistance Systems (ADAS) towards the introduction of self-driving technologies and the completely autonomous vehicles. The estimation of the digital market potential varies between different studies but the common ground is that the digital area offers new business opportunities and will enlarge the traditional automotive market tremendously. Intel for example estimate of a $7 trillion passenger economy, McKinsey expects up to $1.5 trillion - or 30 percent more - in additional revenue potential in 2030 [1, 2]. These long-term perspectives have already strong effects on the present strategies and industry roadmaps. While making decent money with reasonable margins at present, the traditional car manufacturers have to concentrate on a variety of new and emerging technologies simultaneously. Original Equipment Manufacturers (OEMs) have to work in various technology fields (alternative propulsion technologies, mobility services and platform concepts, artificial intelligence, lithium-ion battery production cyber-physical systems for the optimization of manufacturing plants and many more) at the same time. Recent developments considering environmental aspects will further intensify these requirements [3].

2. Self-driving trucks as major business opportunity

Digitalization will be the major driver of change in the truck market [4] and results already in applications for (near) real-time dynamic route optimization and for better capacity utilization. Never the less one essential objective enabled by sophisticated IT-technologies is the fully autonomous truck, which tackles the two largest aspects in truck total cost of ownership (fuel and driver costs) simultaneously. [5] But besides providing solely economic benefits it addresses a variety of the top issues the truck industry is facing (hours-of-service, safety, driver shortage, driver retention, fuel costs, congestion, driver wellness…) and societal issues (emission reduction, accident mitigation, congestion reduction) at once [6]. The Society of Automotive Engineers (SAE) defined in its international standard J3016™ [7] six levels to classify the degree of automation for on-road vehicles with a specific focus on the highest three levels of automation and their operation on public roadways. The automation levels define the required interaction of the driver with the automated vehicle. While autonomous driving is still a future vision, technology solutions for different automation levels were, are and will be offered to customers. Automation is therefore not only as an end result - the autonomous vehicle - interesting to OEMs, they are earning high margins with specific advanced driver-assistance systems (ADAS) in the meantime. ADAS like adaptive cruise control (ACC), lane keeping assistant, and the emergency braking systems, but also technological innovations such as digital 3-D maps are bundled into an overall system in commercial vehicles [8]. A variety of sensors, vehicle control systems and connectivity modules enable the gradual realization up to the fully autonomous truck. Required costs to evolve from one automation level to the next do not increase linear, nor does the complexity of the technological solution. [6]. Besides the obvious benefits of increased safety for all mobility participants, automation enables also new business concepts like Platooning. This describes a formation of multiple trucks which are in constant communication with each other and can therefore drive harmonized at very fast speed. Advanced driving technologies like ACC, collision avoidance, radar, cameras and other sensor systems are enabling the interlinked trucks following the driving behavior of the leading vehicle, the only one driven by a human employee. Platooning technology can therefore save considerable human payments and fuel costs (between two and eleven per cent depending on the position of the truck. [9]

2.1. Premium strategy of European manufacturers

The European Automobile Manufacturers' Association (ACEA) released this year a Roadmap for Truck Platooning and the required implementation steps and recommends also necessary policy adaptions [10]. The European Road Transport Research Advisory Council (ETRAC) describes with a more functional and technical oriented view in its roadmap the necessary steps toward the self-driving vehicle and is referencing different levels of truck platooning [11]. In the European Truck Platooning Challenge drove semi-automated truck platoons from