Key Challenges for Affordability & Competitiveness

Introduction

In the area of Affordability & Competitiveness, co-funded research supports the development of technologies that support a competitive automotive industry, producing affordable passenger and commercial vehicles meeting customer and societal demands, whilst fulfilling more and more challenging regulatory standards. In this Strategic Pillar EUCAR recognises three key challenges:

Digital breakthrough of automotive development and manufacturing

In the second and third decade of the 21st century, the automotive industry is expecting more challenges and changes to meet than in the past century. A wide range of differing requirements starting with societal goals for safe, clean and efficient mobility; user customisation and personalisation; increasing number of differing vehicle types for different mobility solutions and concepts; circular economy; technical regulation; etc. call for more adaptability in the manufacturing processes. Recent technological developments in production such as additive manufacturing (3D printing) or smart industries may provide the solutions to address this key challenge. However, affordability and the benefits of mass-production regarding cost-effectiveness as well as the roles in human-machine collaboration have to be considered. A digital breakthrough of the complete manufacturing processes itself is needed. The central question remains:

How to transform manufacturing processes to fulfil customisation needs, deliver customer experience, vehicle variety and consider future requirements at industrialized mass-production costs?

Affordable lightweight and efficient vehicles

Lightweight design and lightweight materials have been an important research topic across various sectors (e.g. aviation, automotive, shipping industries). Future mobility and vehicle concepts rely heavily on the technological advancements in lightweight construction. The main challenge for automotive applications seems to be cost-effectiveness. All lightweight materials (e.g. composites, aluminium, magnesium and high-strength steel) offer weight reduction but come at higher costs.

In particular, carbon fibres composites have higher potential in terms of weight reduction. However, the successful introduction in mass production vehicles rely on breakthrough technologies for production of raw materials and processing. The expectation for the medium term is that lightweight and weight reduction will become even more important for automotive manufacturers with stricter CO2 regulations. In addition, battery electric vehicles will benefit from weight reduction with increased range. However, considering current customer expectations and willingness-to-pay will pose a certain challenge for the wide-scale implementation of lightweight in automotive applications. An integrated approach combining materials, design, joining processes, product and manufacturing engineering and manufacturing as well as end-of-life strategies are needed to address this key challenge:

How to reduce the average total vehicle weight by ~25% without conceding safety or customer expectations at affordable costs?

Competitive automotive innovation cycles

Digitalisation and connectivity are certainly one of the dominating trends in the first quarter of the 21st century. It modifies the way we think about our future mobility and future mobility needs. However, with this trend comes a major challenge for the automotive industry. The technology cycles of information technology and semiconductor industries becomes more and more relevant for the automotive business. Moore's law (i.e. an observation that chip performance will double every 18 months at half the cost) leads to very short life-cycles in the telecom and computer business (<1 year) which do not match the innovation cycles in the automotive industries (>5 years). Therefore, we have to accelerate our innovation cycles to be able to implement state-of-the-art technologies in future vehicles and meet required time to market from a consumer perspective. Technological advancement in virtual engineering will certainly enable us to go a step further, bringing design, engineering and manufacturing closer together. Virtual certification if implemented will aid in reducing costs and development lead-time. Fast processing and decentralised data handling and management will increase the innovation capability of the industry. Big data and deep learning algorithms will improve the development and engineering processes. However, the central question remains:

How to substantially reduce the vehicle development lead-time and meet required time to market with consistent or improved quality and similar or reduced investments?