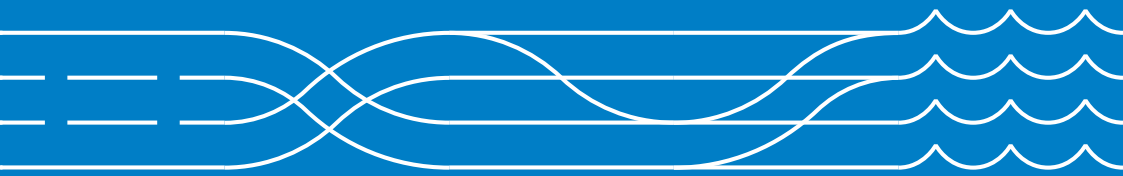
TRANSPORT SCOREBOARD .EU

COMPETITIVENESS OF EUROPEAN TRANSPORT MANUFACTURING INDUSTRIES



AUTOMOTIVE | AERONAUTICS | RAIL ROLLING STOCK | SHIPBUILDING

SHIPBUILDING
AUTOMOTIVE
RAIL ROLLING STOCK
AERONAUTICS

The Coordination and Support Action "Scoreboard of Competitiveness of the European Transport Manufacturing Industry" (SCORE) explores, assesses and forecasts how progress in research and development, new innovative technologies and future demand changes in combination with forthcoming geopolitical and geoeconomic developments affect the global competitive position of the European transport manufacturing industry.

The analysis focuses on the four major transport manufacturing industry's segments: automotive, aeronautics, ship-building and rail rolling stock, all for carriage of passengers and freight. It has a time horizon up to 2030 (and partly to 2050).

The findings are summarized and visualized in a so-called scoreboard that indicates in an easily accessible way the current and future competitive position of the European transport manufacturing industries compared to their global rivals.

Subsequently, orientations for adjustments, changes and expansions of corporate innovation, production and investment strategies, EU industrial competitiveness policies and other measures are provided.

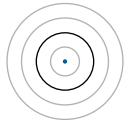
For verification and validation, the SCORE project extensively seeks at various workshops the assessments from an Industrial Advisory Board.

This project has received funding from
the European Union's Horizon 2020 research and innovation programme
under grant agreement No 724112. 2016-2018 SCORE,

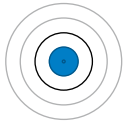
EXPLANATION OF SCORING

SHIPBUILDING | AUTOMOTIVE | RAIL ROLLING STOCK | AERONAUTICS

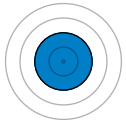
All considered and assessed topics are scored on a 5-point scale if applicable, reaching from strong competitive disadvantage (0) to strong competitive advantage (4). The individual scores are derived from selected Key Performance Indicators and/or qualitative analysis identified for each of the transport modes.



Europe has a strong competitive disadvantage in comparison

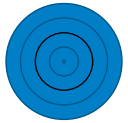


Europe has a competitive disadvantage in comparison



Europe has neither a competitive advantage nor a competitive disadvantage

Europe has a competitive advantage in comparison



Europe has a strong competitive advantage in comparison

STATUS QUO

The status quo analysis assesses the current status and dynamics of value chains, demand-side requirements and the competitive situation of the European transport manufacturing industries. It also provides a fundament for the investigation of disruptive trends and their impact and takes the policy perspective into consideration. The analysis covers both passenger as well as freight transportation. Along its structure, the goals of this analysis are to:

IDENTIFY
the state of the art in manufacturing and production from technological and strategical perspective and to evaluate the current level of implementation in European transport manufacturing industry as opposed to global competitors.

INVESTIGATE
global and European customer requirements and market segmentation.

COMPLETE
the analysis by adding the global view of the competitive position of the European transport industries including a comprehensive economic analysis.

»EUROPE HAS A COMPETITIVE ADVANTAGE IN COMPARISON«

In total, 12 overarching Focus Areas were identified to evaluate the status quo of the European competitiveness. Whereas the technological and economic perspective is scored on a 5-point scale, the demand-side view is of qualitative nature. Based on the quantitative scorings the European Transport Manufacturing Industry has at present a competitive advantage in comparison with its main rivals.

FUTURE

Based on current and emerging trends, knowledge of risk sources and future global transformations, the future analysis anticipates developments that might affect global competitive positions of the European manufacturing industry in markets of interest until 2030/2050. Considering cross-sectoral aspects, the impact of these trends on the setup and dynamics of the value chain and demand-side are assessed including a synthesizing economic analysis reviewing global trends and risks. The analysis covers both passenger as well as freight transportation while in some cases there is no clear separation anymore. Along its structure, the goals of this analysis are to:

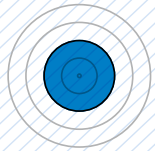
IDENTIFY
the relevant trends and future perspectives that will affect supply and demand of the transport manufacturing industry. A further goal is to analyze their impact on setup and dynamics of value chains and innovation capacities and derive upcoming challenges and opportunities.

FORECAST
likely market developments of present and upcoming markets, changing customer requirements and mobility demands including aspects like demographic trends, GHD reduction targets etc. affecting business models of the addressed industries.

EXAMINE
trends and risks in global business and investment climate, current and upcoming global competitors, economic policies and funding strategies including possible new competitors with disruptive business models.

»EUROPE HAS NEITHER A COMPETITIVE ADVANTAGE NOR A COMPETITIVE DISADVANTAGE«

Overall 34 Research Topics were identified by industry experts to evaluate the future status of the European competitiveness concerning demand requirements and technological aspects. Furthermore a comprehensive expert survey was carried out to assess future global competition areas between European and other global rivals. Whereas the technological perspective and the expert survey are mainly scored on a 5-point scale, the demand-side view is of qualitative nature. Based on the quantitative scoring of the identified 16 Research Topics with a technological focus, the European Transport Manufacturing Industry has has neither a competitive advantage nor a competitive disadvantage with its main rivals.



RAIL ROLLING STOCK STATUS QUO

TECHNOLOGY | DEMAND | ECONOMIC

The technological aspect deals with the setup and level of integration of the value chain of European transport manufacturing industries. This includes an assessment of innovation capabilities and the degree of implementation of the current state of the art in manufacturing as well as production technologies and strategies.

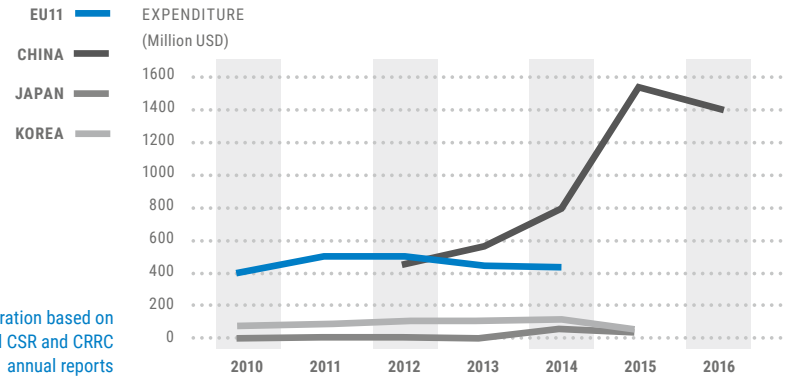
»EUROPE HAS NEITHER A COMPETITIVE ADVANTAGE NOR A COMPETITIVE DISADVANTAGE«

R&D
TECHNOLOGICAL READINESS
WORKFORCE
INNOVATION

R&D

The rolling industry is shaped by a lack of collaborative research and highly protected R&D results. Currently, there is a decreasing trend of private R&D investments in the European rolling stock industry which contrasts the important and increasing R&D investments from the Chinese industry. This new entrant, who built an extensive industrial capacity upon foreign technologies and know-how, has placed innovation at the top of the national agenda. Although its R&D efforts have not yet translated into innovation leadership (as measured by invention activities) and commercial success (as measured by global market shares) in the high-speed rail segment, they might not take long to be fruitful.

Business R&D expenditure of the railway rolling stock industry in selected regions, 2010-2016 (million USD)



Source: author's elaboration based on OECD ANBERD data and CSR and CRRC annual reports

FUTURE

TECHNOLOGY | DEMAND | RISK ANALYS

Within the demand perspective, likely market developments are forecasted and future customer requirements and mobility demands are analysed. Overall the task assesses how future technological developments, business trends and use cases will shape demand and in turn will shape requirements on transport manufacturing industry and their business models. Due to its nature demand aspects are not scored within this project.

SERVITIZATION

In 2030, rolling stock manufacturers have moved from a product-based business model to offering advanced train transportation services. This change has the potential to increase the robustness of the supply chain and to increase the attractiveness of rail transport. European rolling stock manufacturers, who were pioneers in offering train availability services, will undoubtedly enjoy the first-mover advantage capitalised through learning-by-doing competences that will allow them to secure further contracts and remain the global leaders in the provis on of train availability services. By 2025, rolling stock manufacturers would be making half of their revenue from selling vehicles and the other half from aftersales and services.

While private investments in the US and EU are very high, Asian national authorities invest lower amounts in modernizing railways.

SERVITIZATION
CYBER-SECURITY
MULTIMODALITY
DIGITAL CUSTOMER EXPERIENCE

AUTOMOTIVE STATUS QUO

TECHNOLOGY | DEMAND | ECONOMIC

The technological aspect deals with the setup and level of integration of the value chain of European transport manufacturing industries. This includes an assessment of innovation capabilities and the degree of implementation of the current state of the art in manufacturing as well as production technologies and strategies.

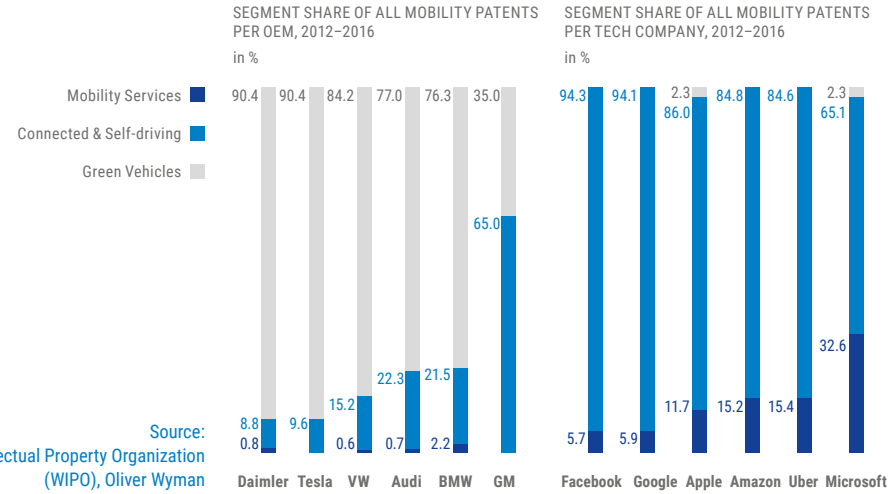
»EUROPE HAS A COMPETITIVE ADVANTAGE IN COMPARISON«

R&D
TECHNOLOGICAL READINESS
WORKFORCE
INNOVATION

INNOVATION

The ICT industry currently disrupts the long standing automotive industry. This can be especially evidenced in North America and China. However, car Manufacturers presently still have a competitive advantage in Europe where there is a rather weak ICT industry when it comes to the quantity of filed patents. In a highly globalised market, the effects of these develoments might be severe for European manufacturers in the future though.

Individual company's patenting visualizing the focus points and therefore indicating business strategies of traditional car manufacturers and new rivals



Source:
World Intellectual Property Organization (WIPO), Oliver Wyman

FUTURE

TECHNOLOGY | DEMAND | ECONOMIC

In order to anticipate future dynamics of value chains in the European transport manufacturing industries, key technological trends and innovative business concepts are analyzed and assessed in terms of their potential impact on the global competitive position.

»EUROPE HAS A COMPETITIVE DISADVANTAGE IN COMPARISON«

CHIPS FOR ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is the key technology for self-driving cars, since unforeseeable events and chaotic behaviour in traffic prevent any form of conventional programmable solutions. By means of deep learning algorithms, artificial neural networks (ANNs) are trained to sense the environment and to navigate a vehicle through traffic. Recent breakthroughs in such machine learning tasks make self-driving cars one of the most promising technological trend in recent times. All major OEMs and Tier1s start to cooperate closely with integrated circuit manufacturers (IC) trying to meet the high hardware requirements, but Europe has to speed up to keep up with advancements in the US and China. Currently, Nvidia uses the 12nm-FinFET while Intel uses the 7nm-FinFET semiconductor technology for their chips to achieve high power efficiency. The corresponding fabs able to manufacture this technology are located in the US and Asia.

The enormous potential impact on all industry segments led to a race for more efficient chips between IC vendors, tech giants, IP vendors and various start-ups. It is remarkable that various start-ups (mainly in the US and China) try to compete with the big IC giants in such a cost-intensive industry branch.

CHIPS FOR ARTIFICIAL INTELLIGENCE
DIGITAL CUSTOMER INTERFACE
CYBER-PHYSICAL SYSTEMS
FUEL CELL PROPULSION

SHIPBUILDING STATUS QUO

TECHNOLOGY | DEMAND | **ECONOMIC**

Complementing the supply and demand perspective, this economic analysis provides the global perspective and also considers the input of policies already in place. By considering the results of the technological and demand perspective, it evaluates the current competitive position of the European transport manufacturers in global rivalry landscapes.

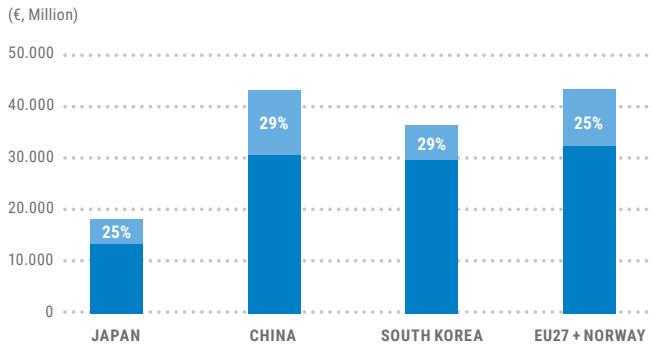
»EUROPE HAS A STRONG COMPETITIVE ADVANTAGE IN COMPARISON«

SUPPORTING INDUSTRIES
VALUE ADDED
FINANCIAL EXCELLENCE
COMPETITION
MARKET DYNAMICS

LABOR PRODUCTIVITY

One of the significant elements of creating high added value in ship production is the productivity of the employees of the European shipbuilding sector. European shipbuilders provide direct employment for more than 150,000 people in Europe and employ an average of about 25 employees, while Chinese companies employ about 350 employees. As regards the production of CGT per company, the average European production per enterprise was 440 CGT per year and was about 15-20 times lower than in China, South Korea and Japan.

Value-added within production value



Source: Study on Competitiveness of the European Shipbuilding Industry, Final report, Ecorys, Rotterdam 2009, p. 98

FUTURE

TECHNOLOGY | DEMAND | RISK ANALYSIS

In order to anticipate future dynamics of value chains in the European transport manufacturing industries, key technological trends and innovative business concepts are analyzed and assessed in terms of their potential impact on the global competitive position.

»EUROPE HAS A COMPETITIVE ADVANTAGE IN COMPARISON«

HYBRID PROPULSION
SMART SHIP
DEEP SEA MINING VESSEL
ADVANCED EMISSION ABATEMENT

DEEP SEA MINING VESSEL

Deep sea mining is regarded as a potential new sources for metals and rare earth elements. It covers the technology-intensive processes of exploration, exploitation, extraction, mining and processing. Commercial deep sea mining is still in the early beginning in international seas and within the Exclusive Economic Zones (EEZs) of many coastal nations. It is legally organised by the International Seabed Authority (ISA), under the U.N. Convention on Law of the Sea (UNCLOS).

Specifically high-technology designed deep sea mining or production support vessels (PSV) play a crucial role in the process as they serve e.g. as dispatching systems, storage buffers, pre-processing facilities like for dewatering and accommodation – and present a mix of drilling vessels, bulk carriers, tankers, and offshore construction vessels.

Currently, the first deep sea mining vessels have been built by the Chinese shipyard Fujian Mawei Shipbuilding and equipped by Rolls Royce diesel engines. The vessel is expected to start operating in 2018. Based on the advance made in economically viable deep sea mining, these specific vessel types have been considered as an opportunity for the European shipbuilding companies to gain a high market share in this niche market – comparable to other niches like cruise shipbuilding and emission abatement technologies.

AERONAUTICS STATUS QUO

TECHNOLOGY | **DEMAND** | ECONOMIC

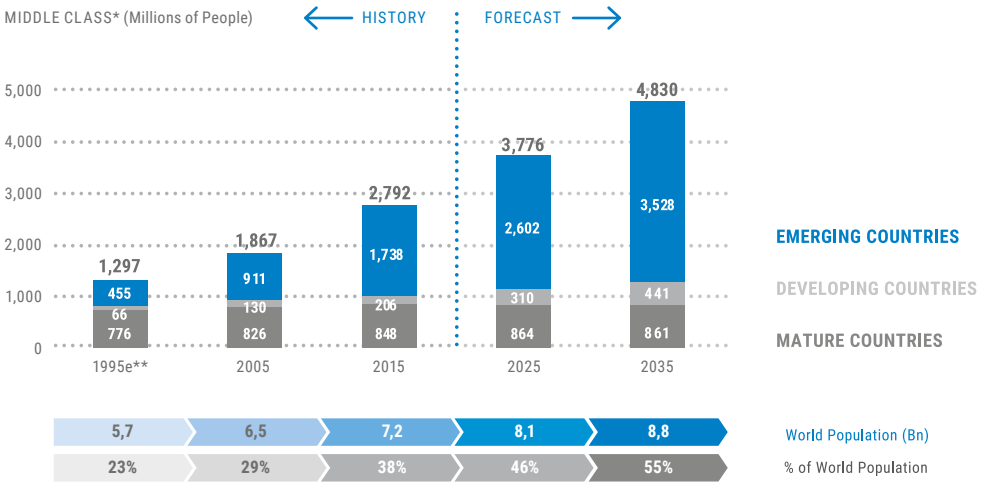
The demand perspective considers societal drivers and takes the main needs, expectations and requirements from the demand side into consideration. Depending on the transport mode, customers are either end users or commercial users such as transport operators. The analysis was undertaken on a global and European scale. Due to its nature Demand aspects are not scored within this project.

SOCIAL
ECONOMIC
DEMOGRAPHIC

DEMOGRAPHIC

Demographic aspects affecting the demand for airborne transport include urbanisation, the size of the working age population and the growing middle class. Emerging and developing economies have a huge impact on this factor. This will influence the need for aircrafts with very different positions for the regions. There are currently 55 aviation mega-cities with one million passengers per day. 90% of longhaul traffic on routes are to/from/via these 55 cities.

Growing middle classes (history and forecast)
Middle Class* to move from 2.8 Billion to 4.8 Billion in 20 years



*Households with yearly income between $20,000 and $150,000 at PPP in constant 2015 prices
**Estimate for 1995 split by region

Source: Oxford Economics, Airbus

FUTURE

TECHNOLOGY | DEMAND | RISK ANALYS

In order to anticipate future dynamics of value chains in the European transport manufacturing industries, key technological trends and innovative business concepts are analyzed and assessed in terms of their potential impact on the global competitive position.

»EUROPE HAS A COMPETITIVE ADVANTAGE IN COMPARISON«

MAINTENANCE, OVERHAUL AND REPAIR SERVICES

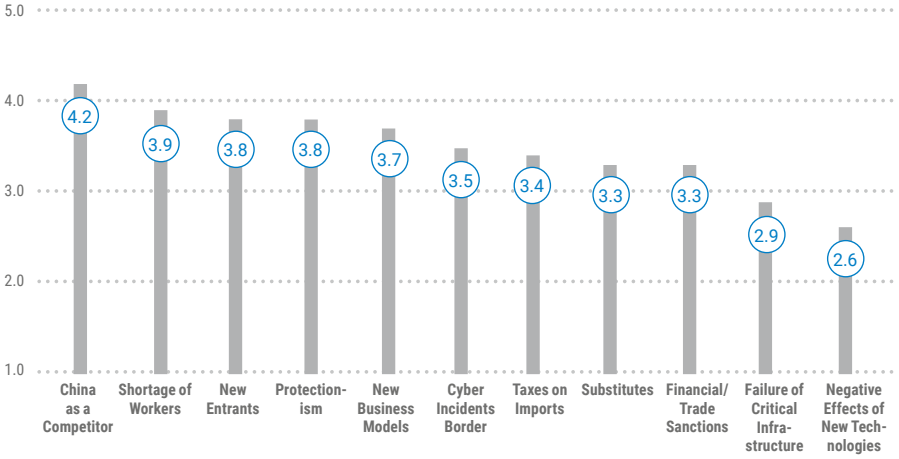
The aviation industry has experienced the influence of disruptive technologies of various forms throughout its history. These inventions have contributed to the improved performance of a specific aspect of the industry each in their own way and have traditionally occurred as significant step changes. Today, we continue to see disruptive technologies emerge and transform the aerospace sector; however, these technologies tend to be developed through a more structured, incremental innovation process such as Technology Readiness Levels. Current and future disruptive technologies are driven by a compilation of specific needs which have been identified as fuel burn efficiency, emissions reduction, affordability, noise reduction and maintenance time reduction. With the assets such as aircraft, a majority of the systems are complex and made of high-value parts. In order to maintain these technologies over a decade, innovative maintenance technologies are a must. Concepts such as engineering for life, bespoke repair technologies, in-situ repair and retrofit technologies control the market.

ALTERNATIVE PROPULSION TECHNOLOGIES
CYBER-PHYSICAL SYSTEMS
PRODUCT SERVICE SYSTEMS
MRO SERVICES

RISK ANALYSIS

Complementing the supply and demand perspective, the main input for the risk analysis is formed by an expert survey that sought to establish how European transport manufacturers along the entire value chain perceive the most severe global and regional risks, the prevalent technological and communication revolution, developments around international trade and market access, and cross-sectoral collaboration. In addition, the survey intends to provide industrial insights regarding requirements for changes in business strategies and European industrial and competitiveness policies in light of the expected future competitive landscape.

Risk Landscape of the European Transport Manufacturing Industry



Source: VDI/VDE Innovation + Technik GmbH 2018

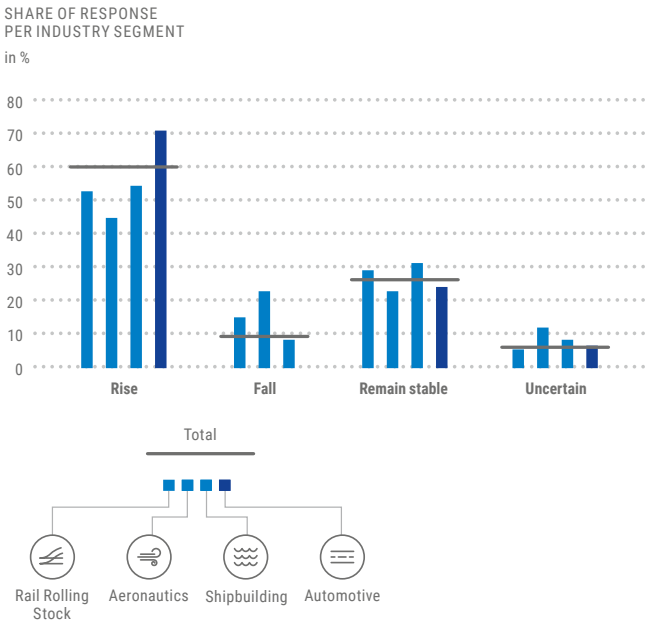
RISK ANALYSIS
SCOREBOARD

AUTOMOTIVE AERONAUTICS RAIL ROLLING STOCK SHIPBUILDING

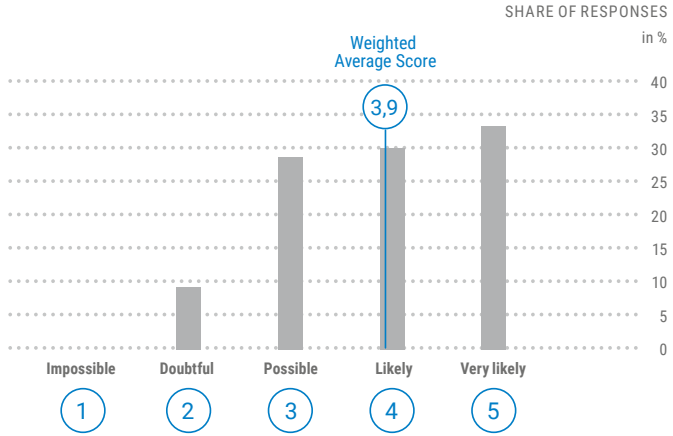
A survey among 69 high-level experts from the four main European transport manufacturing segments identified the following highlights:

- The European transport manufacturing industry is optimistic about technology developments; emerging technologies are largely perceived as opportunities for future competitiveness, not as risks.
- European transport manufacturers are concerned about future access to sufficiently qualified employees, particularly given the fast developments in emerging technologies and the increasing risk of cyber incidents.
- Transport manufacturers are also concerned about strong competition stemming from new business models, new entrants, and particularly from Chinese manufacturers.
- Protectionism and hence reduced market access to major markets of interest is perceived as a likely risk, and the most severe impacts for the industry are considered to be a deterioration of competitiveness and loss of revenues.
- Cross-sectoral collaboration is seen as desirable for increasing the future competitiveness in the industry, but different regulatory frameworks and work practice/culture are considered to be important barriers. For achieving cross-sectoral collaboration, strategic partnerships are the preferred industrial collaboration model.

Rising demand for workers – expectations on employment developments



Will a shortage of qualified workers affect your business and future competitiveness?



Source: VDI/VDE Innovation + Technik GmbH 2018

PARTNERS

The SCORE project in its core consortium consists of eight partners from seven countries. In order to keep the project lean, agile and productive, dedicated companies, think tanks and research institutes have been involved.

Since many of them are key members of European associations and technology platforms working on transport and manufacturing issues or the relevant societal drivers, the recommendations by the project are based on thorough technical and economic assessments as well as industrial roadmaps and they can easily be leveraged.

- VDI/VDE Innovation + Technik GmbH; Germany
- Railenium; France
- Cranfield University; UK
- Maritime University of Szczecin; Poland
- Transportøkonomisk Institutt; Norway
- Institute of Shipping Economics and Logistics; Germany
- IK4 Research Alliance; Spain
- Intl. Association of Public Transport Operators; Belgium

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Future Technologies and Europe

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