RECOMMENDATION PAPER OF THE ETA

ETA

EXPERTENKREIS
TRANSFORMATION DER
AUTOMOBILWIRTSCHAFT

FUTURE OF AUTOMOTIVE VALUE CREATION IN GERMANY

TABLE OF CONTENTS

Recommendations

04

Conclusion and outlook

05

Appendix: Action sheets

06

Appendix: Indicator table

INTRODUCTION

The automotive industry is of exceptional importance to the German economy. In 2023, it generated €564 billion in revenue from domestic production alone, directly employing 780,000 people across Germany. In 2022, the sector invested €28.7 billion in internal research and development – accounting for roughly 35% of the entire R&D expenditure of German industry. Suppliers are a crucial part of the automotive sector and are predominantly made up of small and medium-sized enterprises (SMEs): over 90% of companies in the automotive industry have fewer than 1,000 employees and more than 70% have fewer than 250.

The transformation of Germany's automotive industry is well underway. New registrations of battery-electric vehicles are rising worldwide and production facilities are being restructured. Both production and vehicles are becoming increasingly digitalized and new competitors are entering the market. At the same time, global competition between locations is intensifying, partly due to extensive investment and subsidy programs, especially in the U.S. and China. This has led to a struggle over the future of automotive production and value creation, as the industry is pivotal, with high potential for innovation and economic value and it generates significant spillover effects on other sectors. Currently, there is intense debate over what is needed to strengthen Germany's international competitiveness as an automotive hub.

Building on previous work, the expert panel "Transformation of the Automotive Industry" (ETA), appointed by Federal Minister for Economic Affairs and Climate Action Dr. Robert Habeck, takes a comprehensive view of Germany as an automotive hub. The recommendations presented are the result of an intensive collaborative process. The 13 ETA experts (*see member list*) were supported by numerous specialists from politics, business, civil society and academia and also had access to accompanying scientific research. In total, over 150 people contributed to the development process, ensuring well-considered recommendations that integrate a variety of perspectives.

The ETA presents a document offering broad-ranging recommendations, recognising that individual measures alone cannot secure automotive value creation in Germany. Instead, a coherent overall strategy is needed, combining regulatory policies, fiscal/economic incentives and infrastructure investments in an effective, efficient and socially equitable way. These recommendations are directed at both policymakers – especially the German federal government and the European Union – and the industry, urging all stakeholders to drive the transformation of Germany's automotive sector forward quickly and collectively. Success will depend on the commitment and innovative capacity of management and employees across the automotive ecosystem, supported by reliable and intelligent policy measures.

Overview of the key recommendations of the ETA

Explanation |

The automotive industry's once strong, export-oriented position has been under increasing pressure in recent years due to challenging factors of competitiveness, sluggish productivity, the twin transformation (digital and green transition), new competitors, as well as extensive subsidy programs and protectionist measures from other economic regions.

Strategy |

Germany as an automotive hub must reposition itself in international competition by:

Key recommendations |

a) improving location conditions

Strengthening the location

- > Better factors of competitiveness
- > Strengthening Research and Development
- > Supporting the financing of the transformation
- > Active establishment

b) continuing to convince with quality and productivity

Enhancing quality and productivity

- > Shared value creation through stronger networking
- > Holistic factory: automation of production processes
- > Building and expanding software and AI expertise

c) integrates new value-creation areas

Develop and expand key areas

- > Semiconductor design and manufacturing
- > Automated and connected driving
- > Alternative drive technologies
- > Data-based business models

STATUS QUO

Germany's automotive sector has traditionally maintained a strong international competitive position through exceptional productivity, technical innovation and product quality. High-quality vehicles both technologically advanced and reliable have appealed to customers in Germany and globally. However, this once favourable export-oriented position has been increasingly challenged in recent years by various developments. References to the automotive industry or automotive location in the following paper encompass the entire industry including suppliers.

2.1 Automotive production in Germany: Deteriorating factors of competitiveness and global protectionism put the export model under pressure

Factors of competitiveness significantly impact production costs and future investment decisions. Recently, Germany's attractiveness as a location has declined. Energy costs and bureaucratic burdens are rising and there is an increasing shortage of skilled workers. Productivity growth is insufficient to offset these partly politically driven costs (*see area of action 2*).

Key location factors in Germany have worsened in recent years:

- In 2023, the **cost of electricity** for automakers in Germany reached €190 per megawatt-hour, nearly three times the cost in the U.S. (€68.5), twice that in China (€89.4) and over 40% higher than in Spain (*see 2023 study by AER, BCG, BDI, Eikon and IW*).
- The **shortage of skilled workers** is intensifying due to demographic changes and shifting job roles and requirements, such as the growing demand for battery and software expertise.
- Companies increasingly perceive **bureaucracy** as a burden (*VDA survey*), including lengthy approval processes for replacement and expansion investments and extensive reporting obligations.
- A capable state is crucial to provide public goods, infrastructure, skilled labour and security. This is also in the automotive sector's interest in Germany. However, **effective corporate tax** rates are another cost factor in international competition. Many European and non-European countries use lower corporate taxes to increase their appeal as business locations. German corporate tax levels are seen as high, putting the country under competitive pressure.
- Germany has substantial catching up to do in **transport, charging and digital infrastructure**. Deteriorating transport routes, whether rail or road, challenge production logistics. The number of electric vehicle (EV) charging points falls short of demand, with the expansion progressing too slowly. Broadband and vehicle-to-everything (V2X) infrastructure, essential for connected production and mobility, remain insufficient (*see Fraunhofer IAO/ CAM/ BMWK study 2024*). Germany ranks 48th internationally for mobile download and upload speeds (*Speedtest Global Index*, March 2024
- German automakers rely heavily on non-European imports for six out of 20 **critical raw materials** for industry transformation, such as graphite, lithium, cobalt, nickel, platinum metals and rare earths, similar to other European manufacturers. This dependency is exacerbated by concentrated, energy-intensive raw material processing (*EY/IW/BMWK Study, 2023*)
- **Standardisation and government regulations** need to be better aligned to accelerate innovation processes, particularly in the context of fast development cycles in digital and sustainable transformation (see *Fraunhofer IAO/BMWK Study 2024*). The expert council shares the view from the Draghi Report that taking an active role in standardisation and regulation is crucial for maintaining competitiveness in innovative business areas (*see Draghi Report: The Future of European Competitiveness 2024*).

- **Availability of capital**: Adequate investment financing is critical for success during transformation, but it comes with particular challenges. Some stages of transformation, such as scaling new technologies and business models, are highly capital-intensive. Basic innovations carry significant risks for companies and the time horizons until investment profitability are longer. Suitable financing instruments, such as venture capital funds and a startup culture are less developed in Germany (*see Startup Verband Innovationsagenda 2030*). As a result, companies in Germany often lack sufficient access to capital. In recent years, non-European countries have introduced new, **extensive funding programmes** (e.g., the U.S. Inflation Reduction Act). These can be accessed more quickly and easily, but they sometimes contain protectionist elements (e.g., localisation requirements, origin rules). Additionally, there are general trends of market protectionism and protection of domestic businesses. These measures **in other economic regions** disadvantage the technology- and export-oriented location of Germany and increase the incentives for German and foreign car manufacturers and suppliers to establish their production locally in foreign markets. Within the EU, Eastern European countries in particular stand out with better location and cost conditions, as well as the possibility of higher funding quotas at the EU level.

As a result of all these developments, German car manufacturers and suppliers have significantly expanded their **production in non-European and European countries** over the past decade, while production in Germany and exports from Germany have declined[1]. In 2010, 5.6 million cars were produced in Germany, of which 4.2 million were exported. By 2023, car production in Germany had fallen to 4.1 million, with 3.1 million being exported[2]. At the same time, German vehicle manufacturers (Original Equipment Manufacturers, OEMs) produced 6.1 million cars abroad in 2010. By 2023, this number had increased to nearly 10 million, including 4.3 million in China, 3.0 million in the European Union and 0.9 million in the USA. This trend often went hand-in-hand with an enhanced market presence abroad. However, some of the production volume used for exports from Germany has been replaced domestically. This shift in automotive production could not be fully compensated by the establishment of international manufacturers or suppliers in Germany (despite the arrival of companies such as TESLA and CATL). Even the new Chinese manufacturers entering the market are not producing their vehicles in the European Union. If anything, Chinese and international manufacturers and suppliers increasingly prefer locations in other European countries over Germany for their factories (similar to the preference shown by German and European manufacturers), as they find better factors of competitiveness there (e.g., the large CATL plant in Hungary). In light of these developments, there is an ongoing debate about tools in the trade conflict between the USA, China and the European Union. A potential conflict poses another significant risk to Germany's export-oriented automotive sector.

Although the volume of vehicles exported from Germany to China has decreased, a substantial portion of value creation and employment still depends on these exports and free market access. The adjustment tariffs initially approved by the European Commission must be viewed critically, given the expected and already threatened countermeasures from the Chinese side. This is especially concerning as the reactions to the conditions faced by German manufacturers in China and export-oriented companies in Germany and the EU could have negative consequences.

At the same time, it is important to consider incentives to significantly increase the European and German value-creation share of vehicles sold here by international manufacturers. This requires, above all, an active location and industrial policy, which also includes an active trade policy.

Exports play a significant role for the automotive industry in Germany. Trade barriers in key target markets have contributed to the relocation of production to those regions. Therefore, advocating for worldwide free market access is in the core interest of Germany.

1 Unlike production volume, gross value added has increased since 2010. This is mainly due to the relocation of the production of lower-priced vehicles abroad. As a result, the average price, as well as the average gross value added of the vehicles still produced in Germany, has risen. However, this increase will not be able to fully compensate for the production loss, as domestic gross value added comes under pressure with the growing share of electric vehicles in production, especially as long as there is no significant battery production in Germany.

2 This statistic refers to all passenger cars produced in Germany, including those from non-German manufacturers.

2.2 Production: Productivity is stagnating, processes are inadequately aligned with the transformation potential of the automotive industry

Germany has long been characterised as an industrial location with a balance of high costs and high productivity (*see International Federation of Robotics 2023, Südekum et al. 2020*). However, this balance has increasingly been lost in recent years:

Productivity[3] in Germany is growing at an increasingly slower pace. In comparison to other OECD countries, Germany's industrial productivity growth is now in the middle of the pack (*see Marcobond, vfa 2023*). In the future, productivity in the industry will hardly improve through robotics in a traditional lean production system, which relies on sequential, standardised processes and incremental improvements to avoid waste (*see Almeida et al. 2023*). New technologies, such as artificial intelligence and new production methods, like cyber-physical production systems, will enable the productivity leaps of tomorrow. Developments towards the software-defined vehicle and electrification also introduce new requirements for value creation processes. Software is playing an increasingly important role in both product and production, demanding shorter and more agile development cycles (*see Roland Berger 2020*).[4]

The workforce is still well-educated, but it is only limitedly prepared for the skills required in the future. The aging Baby Boomer generation is retiring and is inadequately replaced by new skilled workers. Due to geopolitical tensions and supply chain issues, the prices for intermediate products, energy and consumer goods have risen significantly. This leads to an increase in material costs and, through high wage demands and settlements, also in labour costs (*see IW Trends 1/2024*). In 2023, labour costs in the German automotive industry were € 62.4 per hour, compared to € 43.6 in the USA and only € 24 in Japan (see Eurostat, national offices and VDA calculations).[5] When looking at the entire economy, the EU countries had an average of 8 percent lower labour unit costs than Germany in 2021. Japan can compete with 21 percent lower labour unit costs and the USA with 26 percent lower labour unit costs for industrial contracts (*see IW-Trends 3/2022 Labor Unit Costs*).

To become internationally competitive again as a location for automotive value creation, production systems urgently need to be aligned with a path of sustainable productivity growth and geared towards the transformation potentials of the automotive industry.

3 Productivity, understood as value creation per employed person.

4 Therefore, the concept of productivity should also be expanded: Important factors, such as the use and benefits of energy or the digitalisation of development and products (software), should be integrated into the concept and metrics.

5 In the international comparison of labour costs (related to the automotive industry) and in the international comparison of unit labour costs (relative to the entire economy), the significant wage increases achieved by the UAW (United Auto Workers) for employees in the automotive industry in the US in 2023 have not yet been accounted for.

2.3 Digital and green Transformation: Germany needs to catch up in all key areas of future value creation

With the digital and sustainable transformation, the automotive ecosystem is changing. Completely new areas are emerging and becoming increasingly important for both production and products: The shift away from fossil fuels necessitates the transition to alternative drive systems. Batteries and the upstream and downstream processes of their production (raw materials, components, recycling) are moving to the forefront, along with fuel cells or alternative fuels for certain vehicle classes. The digital transformation in the automotive industry is primarily focused on specific semiconductors, software and mobility data, which enable functions like automated and connected driving, infotainment offerings and other data-driven mobility services.

With the electrification of vehicles, **batteries** are becoming a central element of value creation. Around one-third of the value of a battery-electric vehicle (BEV) is tied to the battery itself (*see McKinsey 2023*). However, battery technologies are still far from fully matured. The conventional lithium-ion battery is expected to dominate the market for at least the next 5 to 10 years, but alternative technologies and cell chemistries for batteries, such as solid-state batteries, as well as new methods for reusing old batteries, hold immense innovation potential (*see ETA innovation paper and accompanying study*).

The extraction of raw materials required for batteries (especially lithium, nickel, cobalt, manganese and graphite), their processing and the manufacturing of batteries takes place almost exclusively outside of Europe. While the extraction of crucial raw materials occurs in various countries, the processing of these materials (*see Raw Material Study EY/BMWK 2023*) and the manufacturing of batteries are heavily concentrated in China. As a result, the future standards and regulations are also being developed and set in these countries. In 2022, China produced 71% of lithium-ion batteries, Europe only 11% and the USA just 10% (*see McKinsey 2023*). German automakers are already responding by diversifying their sources, forming new partnerships and engaging in additional activities to reduce their dependence on China, though this will only partially succeed in the short term.

The forecasts for battery cell manufacturing in Germany are promising, but so far, these are primarily planned or under-construction facilities. The EU Critical Raw Materials Act and the EU Battery Regulation aim to ensure that raw materials are sourced within the EU and that the batteries used within the EU contain an increasing proportion of recycled materials. In Germany alone, companies are investing more than €13 billion within two EU battery IPCEIs ("Important Projects of Common European Interest") – including grants – and plan to create around 10,000 direct jobs and 180 GWh of cell production capacity (*see BMWK 2021*). In total, 545 GWh of capacity is either under construction or planned in Germany (*see Battery Atlas 2023*). The realisation of these production capacities in Germany and Europe will heavily depend on whether Germany and Europe credibly and sustainably commit to the expansion of electromobility, providing the investing companies with the necessary long-term planning security.

In all vehicle classes, including light and heavy commercial vehicles, battery-electric drives currently represent the most advanced technology, the highest market readiness and hold a clear advantage compared to alternative options. However, for specific niche applications, **hydrogen fuel cell drives or hydrogen combustion engines** may also provide a viable complement, helping to make road freight transport and specialised vehicle sectors CO_2-neutral. As a result, all manufacturers are conducting research and development on such drives and vehicles to varying extents. Among the advantages of hydrogen are its transportability and storability in large quantities, as well as its flexibility and performance, comparable to conventional drives with short refuelling and downtime. Nevertheless, among the experts consulted for the present paper and members of the ETA, there are differing opinions regarding the future relevance of hydrogen solutions for heavy-duty vehicles.

Some experts within the group emphasize the importance of technological openness in the transformation process concerning hydrogen solutions, as well as the advantages of hydrogen for sector coupling (electricity, heat and mobility). The results of the BMDV's Cleanroom discussions indicated specific production volumes on a scale that clearly points to a relevant market (*see NOW 2023*). Additionally, the expansion of an electric charging infrastructure and the simultaneous introduction of heat pumps generate significant uncertainties regarding the balancing and capacity limits of power grids. Green hydrogen is also seen as essential for balancing fluctuations in renewable energy through integrated electrolysers at grid nodes, helping to avoid curtailments and redispatching.

Other experts within the group point to the higher technological maturity of battery-electric solutions and the high costs associated with the hydrogen and fuel cell truck system, as well as the need to establish a parallel infrastructure for hydrogen. Battery-electric trucks are already available in all size classes and today they are cost-competitive with diesel trucks in terms of total cost. When or if this will be the case for hydrogen trucks (e.g., hydrogen costs) is currently uncertain. Therefore, the limited funding resources should initially be focused on building the charging infrastructure for battery-electric trucks.

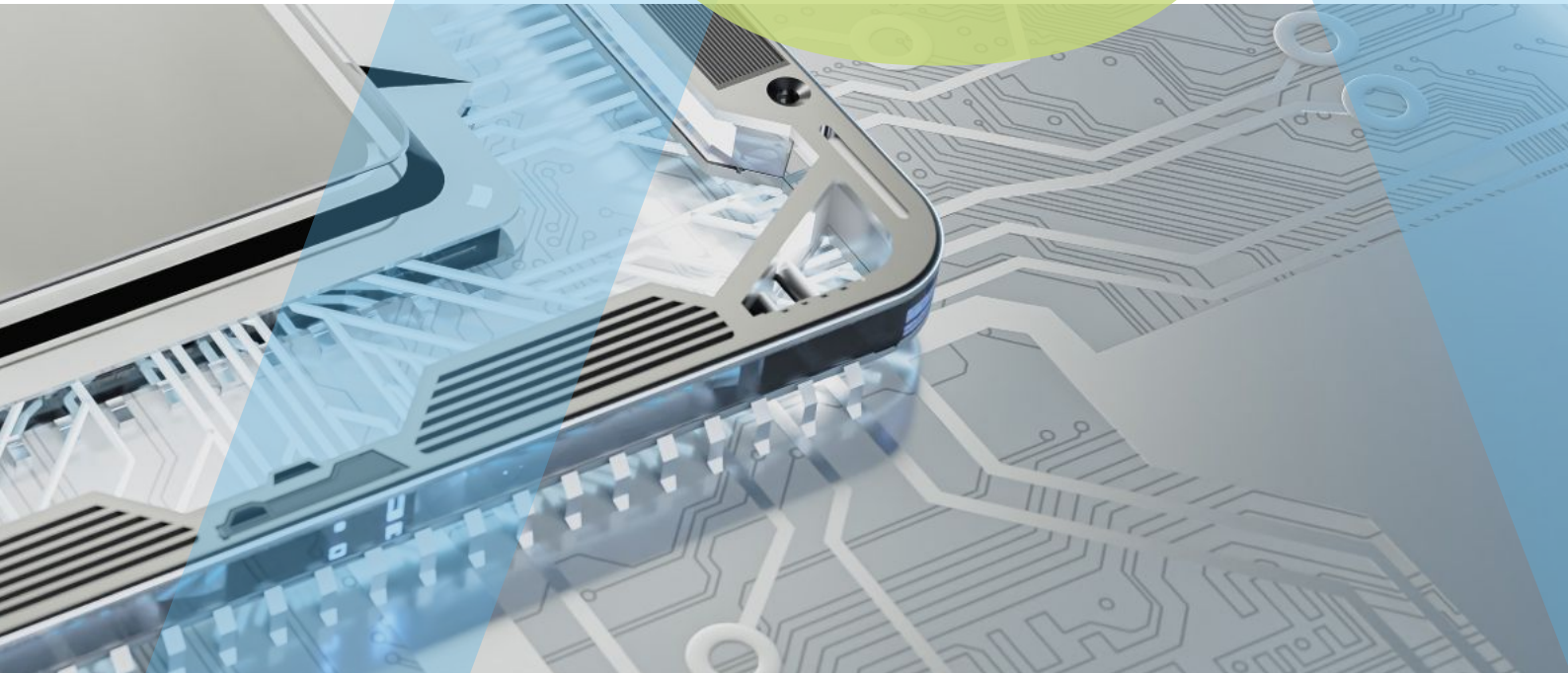
In software-defined vehicles with electric drives, **semiconductors** play a central role. Applications for autonomous and connected driving, along with other digital applications, require semiconductors tailored specifically to these highly

specialised functions. By 2025, the cost of semiconductor end products in a premium vehicle is expected to reach approximately $7,030 (*see Roland Berger 2020/Computer on Wheels*). The global semiconductor market is projected to exceed a total volume of one trillion dollars by 2030 (*see Statista.com*). Currently, only around 10 percent of global semiconductor production takes place in Europe (*see EU Chips Act*), with this 10 percent focused on frontend processes, while nearly all backend manufacturing occurs outside the EU. However, Germany and Europe hold an essential position in the complex value chain through their collaboration among ASML, Trumpf and Zeiss in EUV lithography. Additionally, Germany is competitive in power semiconductors and certain other sub-segments (*see ETA's semiconductor paper*). With existing and planned semiconductor production facilities in Germany, the aim is now also to strengthen the availability of custom-built chips (build-to-print) for the German automotive industry, thereby enhancing its capabilities in specific component customisation.

In the field of **automated and connected driving**, companies in Germany's automotive sector, including manufacturers and suppliers, are among the global leaders. For example, Mercedes and BMW have approved systems that already enable Level 3 automation on highways in traffic situations. Efforts are also underway, such as those by the French company EasyMile (in Monheim and Kelheim) and VW/Moia (in Hamburg), to deploy Level 4 shuttles in regular operation. However, the research and large-scale testing of Level 4 vehicles and systems are currently concentrated in the United States and China (*see ETA's CAD paper and associated study*). To remain at the forefront of automated driving functions, further efforts from manufacturers, authorities and operators are necessary.

The collection, transmission and analysis of vehicle and usage data open entirely new possibilities for **data-driven business models**. Mobility solutions can be personalised and updates and upgrades can be deployed or activated "over-the-air" (OTA) during use without the need for a workshop visit. As technology evolves and customer preferences shift, software is updated throughout the vehicle's lifecycle (*see McKinsey 2023*). New market entrants from the United States and China have already focused their customer experiences on software-defined vehicles with electric drives.

The new digital and sustainable sectors of the automotive industry are therefore central to Germany's economic landscape. They will constitute a large share of future value creation and revenue potential and will be crucial for competitiveness, as they enable qualitative (and cost- and price-based) differentiation in the market. Moreover, establishing these sectors enhances the overall innovation capacity of Germany's automotive industry, as the close spatial proximity of different parts of the ecosystem fosters exchange, collaboration and progress. Finally, having a well-developed battery and semiconductor production, for example, would also increase the resilience and sovereignty of the automotive industry.



STRATEGIC APPROACH: ACTIVE INDUSTRIAL POLICY FOR TRANSFORMATION

Against the backdrop of this complex landscape, the ETA recommends a strategy with three key focal points to improve the international competitiveness of Germany's automotive sector:

01

ESTABLISH A FOUNDATION FOR NEW STRENGTH IN THE AUTOMOTIVE INDUSTRY BY IMPROVING FACTORS OF COMPETITIVENESS IN GERMANY

To strengthen Germany's relative position in the international competition, the conditions for domestic automotive production must be significantly improved. Energy costs need to be reduced and unnecessary bureaucracy must be eliminated. At the same time, the transport, charging and digital infrastructure must be future-proofed, skilled workers must be secured and supply chains for raw materials and components must be made more resilient (similar recommendations also exist at the European level, see the Draghi Report: **The Future of European Competitiveness 2024**). Furthermore, the funding and innovation system needs to be strengthened and made more flexible. For a successful transformation, financing options – especially for suppliers and SMEs – must be improved. Finally, a strong domestic market is crucial for the development of the supply side, so Germany should be reinforced as a leading market. By increasing productivity (*see area of action 2)* and reducing production costs, production in Germany could be extended to some extent into the lower-priced vehicle segments. This would also make the location more resilient to global demand fluctuations between vehicle segments and help stabilize employment in Germany. However, attractive factors of competitiveness are essential for companies to make their productivity-enhancing investments in Germany rather than in other countries.

02

ENABLE SUSTAINABLE PRODUCTIVITY GROWTH AND INNOVATIONS THROUGH INTERCONNECTED VALUE CREATION, A NEW PRODUCTION PARADIGM AND SCALED CORE TECHNOLOGIES

The entire ecosystem of the German automotive industry must significantly increase its productivity to remain internationally competitive. For sustained and high productivity growth, a radical interconnection across the entire value chain is necessary. In regional clusters and production networks, development can be done collaboratively, parts of the value chain can be aligned and investments can be pooled. Through cross-company, multilateral data exchange, the full value of Industry 4.0 can be realised. Accordingly, at the factory level, production must shift to a more flexible, modular and digitised approach, with a holistic Production System 4.0 (GPS 4.0). Only through a fundamental shift will substantial productivity leaps and the proper alignment of production to meet the demands of modern software-defined vehicles and their components be possible. Companies should focus on the development, implementation and, most importantly, scaling of core technologies within their production systems. A central component of this is software: stakeholders in the German automotive industry – ranging from OEMs to SMEs – must focus on the development and deployment of software, as well as the necessary infrastructure for product and production.

03

BUILD KEY AREAS OF NEW VALUE CREATION AND INTEGRATE THEM INTO THE GERMAN AUTOMOTIVE ECOSYSTEM

Germany cannot poaasition itself as a location in the long term primarily through costs or low prices in the market. The quality and attractiveness of the products must ultimately remain the decisive differentiating factor for German automotive production in as many vehicle segments as possible. German companies can maintain their market position, create value and reduce dependencies if they establish a leading position in the new value creation areas (battery, semiconductors, autonomous and connected driving – ACD, AI, etc.) in terms of processing quality, equipment, technology and their own intellectual property (IP).

In other economic regions, there is already active intervention in the changing market through support for domestic production, also aimed at attracting the new key areas of value creation in automotive production. Against this backdrop, it seems necessary not only to accompany the transition with traditional regulatory policies but also to complement them with an active support and settlement policy, as outlined in the *National Industrial Strategy* presented by the BMWK in October 2023. Thus, all aspects of the (new) ecosystem, from raw material extraction and intermediate products to the new areas of value creation, should be consolidated within the German and European automotive ecosystem. This concentration of key value creation areas is particularly essential for success during the transformation phase.

THE FUTURE OF EUROPEAN COMPETITIVENESS – THE ETA RECOMMENDATIONS IN LIGHT OF THE DRAGHI REPORT

Mario Draghi presented a report on September 9, 2024, offering a vision for the future of European competitiveness. The former president of the European Central Bank was given the opportunity by the President of the European Commission to contribute to the analytical foundation for a new EU plan focused on sustainable prosperity and competitiveness. At its core, the report recommends a better-coordinated industrial policy and significant joint investments to close the technological gap between European industry, the USA and China, accelerate decarbonisation and reduce dependencies.

Regarding the automotive sector, the report discusses the greatest structural transformation in over 100 years, driven by new geographical focuses and the emergence of new value chains for electric vehicles, digital technologies, mobility and the circular economy. EU automotive production suffers from higher costs and increasing dependencies in raw materials. Draghi identifies key areas of action including the manufacturing of battery electric vehicles and battery cells, the development and integration of software (software-defined vehicles, autonomous driving stages 2+, 3 and 4), user-friendliness (human-machine interfaces and navigation systems) and development time.

To remain competitive, particularly against China, the report provides ten concrete recommendations, including lowering energy costs, expanding charging infrastructure and creating regional clusters. An EU industrial action plan for the automotive industrie is specifically proposed to improve coordination within the value chain, implement coordinated national policies and ensure the financing of necessary measures.

The Draghi Report acknowledges the importance of AI and digital business models, with a recommendation for broader promotion within the framework of Important Projects of Common European Interest (IPCEIs). However, the ETA goes further, recommending comprehensive support for the use of AI technologies specifically aimed at boosting productivity (*see section 4.2*).

RECOMMEND-ATIONS

From the overarching strategy, the following recommendations for action are derived. These have a guiding level of specificity. Selected recommendations are presented in detailed action sheets in the appendix of the paper and they are marked accordingly here.

4.1 Area of action 1: Establishing the foundation for new strength in the automotive industry through improved factors of competitiveness in Germany

The factors of competitiveness in Germany must be aligned with competitive production costs and an innovation-friendly environment to maintain value creation and encourage new investments. Therefore, the ETA provides various recommendations to make Germany's automotive sector more attractive again. The "hard" factors, such as energy costs and bureaucracy, need to be improved. At the same time, the research and innovation system must be reformed, opportunities for capital provisioning and availability should be enhanced, an active settlement policy should be pursued and the lead market should be strengthened. These actions are essential to ensure that Germany remains a competitive and attractive location for automotive investments and innovations.

IMPROVING FACTORS OF COMPETITIVENESS IN GERMANY

- **Lowering energy costs:** The discussion on an effective industrial electricity price has not led to any results due to differing opinions across politics, academia and economics. The approved reduction in the electricity tax to the EU minimum level provides relief for a broad range of companies. However, the main reason for the continuing cost disadvantage compared to other countries is the rise in electricity transmission grid fees. The removal of the subsidy for grid fees in last year's budget negotiations was counterproductive. A new solution must be found here. We need a cap on grid fees and a permanent reduction of the electricity tax to the European minimum level.

- **Reducing bureaucracy:** Companies face significant burdens due to a multitude of bureaucratic requirements. They often struggle to meet tight deadlines for implementing new regulations and must mobilize extensive technical resources for preparation. Even well-intentioned initiatives, such as the EU's End-of-Life Vehicle Regulation (*see EU KOM 2023 proposal for circular design and disposal of end-of-life vehicles)*, are undermined by bureaucratic implementation, leading to disillusionment among many companies. There are numerous opportunities to reduce bureaucratic requirements without compromising the original objectives. As we transition to climate-friendly mobility and a new generation of vehicles, speed is crucial for both international competitiveness and climate protection.

- We need to accelerate infrastructure development, including in rural areas, for renewable energy, charging stations, energy infrastructure and digital networks. This requires speeding up planning and approval processes through digital and modern administrative procedures, as well as reducing inefficiencies in the system. It should also be examined how approval processes for replacement and expansion investments can be more decoupled from existing operational components, as additional requirements for investments in already existing parts of the business increase investment costs and uncertainty, which can slow down investment. The LNG Acceleration Act, the amendment to the Renewable Energy Sources Act (EEG) and the federal-state pact for accelerating procedures have shown that politics can help speed up necessary societal and climate-related projects (*see action sheet 1 – Reducing bureaucracy in the appendix*).

- **Securing skilled workers:** The state should make training and education programs more flexible for people without a school diploma or recognised professional qualifications. There is a significant untapped domestic potential in this area. The implementation and success of the recently passed Continuing Education Act should also be monitored. At the same time, a fair and active immigration and integration policy for skilled workers should continue. The new Skilled Worker Immigration Act is a step forward. Moreover, a shift in mindset is required, including clearer structures in government agencies, widespread digitalisation to significantly speed up processes and relieving administrative burdens. This also involves ensuring that agencies have the personnel with the necessary qualifications to accelerate complex application and approval processes. Cross-company exchanges on personnel needs should be supported and strengthened through social partnership. Companies should intensify their strategic workforce planning and align learning opportunities with future competencies – using new learning methods (*see ETA Skilled Worker Paper*, *ETA Structural Policy Paper*, *IW/BMWK Continuing Education Needs Study*, *IW/BMWK Hearing Report*).

- **Expanding transport, charging and digital infrastructure:** The state must urgently upgrade the traditional transport infrastructure (bridges and roads). In particular, network bottlenecks need to be eliminated to reduce detours and traffic jams, thereby significantly decreasing CO2 emissions. The expansion of the charging infrastructure must be prioritised and accelerated. Furthermore, traffic infrastructure data should be made available, broadband connections need to be widely accessible and V2X (vehicle-to-everything) and communication infrastructure, as well as regulations and data standards, should be standardised – especially for applications in automated and connected driving (*see Fraunhofer IAO/CAM/BMWK Study and ETA CAD Paper*).

- **Securing raw material supply: T**he state should create transparency through central monitoring and harmonise regulatory requirements regarding raw materials. Shared responsibilities between industry and politics include: securing and diversifying non-European imports, exploring and processing domestic raw materials, increasing recycling rates, closing material loops and advancing technological innovations such as raw material substitution in these areas (*see ETA Raw Materials Paper*).

- **Strengthening and reforming standardisation and norming:** Standardisation and norming are crucial for the (inter-)national success of innovative vehicle technologies in and from Germany. The successful harmonisation of necessary ecosystems is a prerequisite for leveraging network effects and efficiently managing the additional efforts required due to increasing technological complexity. However, standardisation and norming must operate under changed conditions. Examples of this include the faster pace of technological development, new international players and the resulting increase in efforts and resource requirements. To address this evolving environment, several actions are recommended:

  To make the standardisation and norming system more effective, communication and cooperation platforms must be optimised and strengthened. Strategies targeting specific technological areas should be transformed into cross-industry, non-discriminatory initiatives that make use of the established structures of standardisation and norming. There is also a need for more intensive communication to better synchronise the various levels of work.

  The government should support the knowledge-building for standardisation and norming by removing regulatory barriers and providing financial support for project-related studies and administrative efforts. Additionally, the government should support the enforcement of standards to harmonise socially relevant ecosystems.

  Companies and associations should clearly define, document and communicate the importance of standardisation and norming. It is important to reduce internal compliance and cost barriers and to make the standardisation processes more efficient by establishing central coordination offices within organisations (*see Fraunhofer IAO/BMWK Study 2024*).

- **Promote international harmonisation of carbon accounting:** It is urgently necessary for the German government to initiate processes for the international harmonisation, standardisation and verification of relevant methods at both the EU level and internationally, particularly with key reference markets such as China, Japan, Korea and the USA (*see Carbon Accounting Paper of the ETA*).

STRENGTHEN RESEARCH AND DEVELOPMENT

- **Expand funding programs and tax incentives for research:** The state should address all central components of the automotive ecosystem with its funding policy, as synergies, creativity and innovations arise only through the collaboration of various parts of the ecosystem – particularly in regional automotive clusters. Existing funding programs with this focus, such as the “Zukunftsinvestitionen Fahrzeughersteller und Zulieferindustrie" ("Future Investments for Vehicle Manufacturers and Suppliers") (Kopa 35c) program or the “Zukunftsfonds Automobilindustrie" ("Future Fund for the Automotive Industry") should therefore be evaluated, further developed based on experience and restructured (*see Paper on structural policy measures of eta*). Additionally, tax incentives for research should be expanded. The increase in the assessment threshold under the Growth Opportunities Act to 10 million euros per year is a step in the right direction, but it is not sufficient on its own to catch up in the international location competition. Further measures, particularly addressing the needs of SMEs, are desirable.

- **Set incentives for capital investments:** The state should continue to set incentives for companies to achieve productivity gains (continuation of Kopa 35c). The investment premium for climate protection and digital economic goods, which has been outlined in the coalition agreement and is long overdue, should be introduced.

- **Facilitate grant applications and administration:** As the BMWK states in its National In-dustrial Strategy, there is an urgent need for "easing access to funding programs and simplifying the application process" (*see BMWK Industrial Strategy 2023*).

  The feedback both from the ETA hearing and surveys conducted by ETA shows that the speed and quality of the substantive work, such as the BMWK-funded transformation regions, are heavily dependent on time-consuming administrative conditions. While there is clear consensus that tax money must be spent responsibly, it becomes evident that the administrative processes are too complex and time-consuming, tying up significant re-sources. Clarifying detailed questions takes much time and can, in the worst case, put the entire implementation of the funding project "on hold." The interpretation of financing rules can lead to differing interpretations, resulting in varying financing possibilities across different projects.

  Therefore, it is not helpful to write increasingly detailed and comprehensive "guidelines" in the hope of covering every individual case. It is more effective to set general principles, define financial benchmarks (e.g., Federal Travel Expenses Act, Procurement Law) and leave the detailed decisions to the project implementers, who should evaluate them con-sidering the project's objectives.

  The action sheet (*see action sheet 2 – Facilitate grant applications and administration in the appendix)* outlines how the submission of grant applications and particularly their ad-ministration, can be improved and made more efficient. This would allow a stronger focus on the desired substantive goal of the funded – and thus substantively justified – project, with less concern about its administrative handling. The recommendations include, among other things, the abandonment of unrealistic advance planning in the use of funds, the possibility of adapting measures within projects more quickly and easily to new insights, aligning project implementation more with overarching goals and less with detailed long-term project and financial plans, streamlining administrative processes (e.g., in procure-ment and tenders), improving funding databases to facilitate quicker and more targeted program searches and additionally allowing funding according to US-IRA methodology, which not only supports investments but also production. Furthermore, the establishment of a working group consisting of representatives from the BMWK and the project sponsor VDI/VDE is recommended, which would propose simplification options within the framework of the applicable grant and administrative law over the next six months.

- **Expand testbeds:** The federal government should design the planned Real Laboratory Act in such a way that real laboratories are future-proof, bureaucratically streamlined, quickly approved and open to all stakeholders and technologies, while particularly involving those who will later use or offer the innovation. Furthermore, they should generally be designed to be transparent and accessible. Barriers to joint pilot facilities between business and science should also be removed (*see Innovation Paper of ETA*).

SUPPORT SMES IN THE SUPPLY INDUSTRY WITH THE FINANCING OF THE TRANSFORMATION.

\ In Germany, **small and medium-sized enterprises (SMEs)** often face the significant challenge of obtaining sufficient capital for their large investment needs in the transformation. In particular, the step towards scaling new technologies and business models is capital-intensive and at the same time crucial for securing value creation in the standard location, Germany. For transformation investments, companies – many of them SMEs – often lack sufficient access to capital. The middle class finances its investments largely through bank loans, which, alongside internal financing, are the most important source of financing for small and medium-sized enterprises in Germany. Banks tend to be cautious with credit issuance for the automotive industry and suppliers, given the high risks and significant uncertainty in the market. A contributing factor is the tightening of the regulatory environment for banks (particularly taxonomy, Basel IV, ESG analyses). The federal government should advocate at the EU level for interpretations or legal changes that positively affect transformation financing, especially for SMEs. Additionally, improved access to capital markets, for example through simplified issuance of shares and bonds, would expand companies' financing options (*see Annual Report SVR 2023/24*).

Furthermore, liquidity and equity support models, subsidised public loans, or the backing of private capital should be considered. Tax depreciation options could incentivize capital collection agencies to allocate small parts of their portfolios to finance innovations. The “Beteiligungsfonds für Zukunftsinvestitionen" ("Investment Fund for Future Investments") launched by the federal government in 2021 at KfW should be significantly increased. At the same time, the expansion of the Future Fund at the EU level should culminate in a joint European VC platform through closer collaboration between promotional banks and venture capitalists. In the concrete implementation of the EU taxonomy, more clarity should be provided for all parties involved. Automotive suppliers, for example, need to know when their CO2 reduction is considered "sustainable" under the taxonomy, as this has a significant impact on the risk assessments for financing by banks and, ultimately, on the interest rates of loans.

ACTIVELY ATTRACT INVESTMENT

\ **Continue direct support during the transformation period:** During times of simultaneous transformation and geopolitical tensions, direct support for individual establishments should not be avoided. Such subsidies can yield economic and taxpayer returns through various follow-up effects: value creation and jobs are generated, supply chains become more resilient and just-in-time deliveries are simplified. Additionally, the carbon footprint is reduced due to shorter transport routes. Germany and the European Union need the impulses of these subsidies to build innovation-driven clusters and ecosystems, making them more resilient to external influences. However, this direct support should be guided by clear criteria. It should focus on value creation areas that 1) are strategically important for the automotive industry, 2) involve significant dependence on other economic regions (especially China) and 3) have a strong position in international competition, offering a realistic chance to provide competitive products and services (*see ETA's semiconductor paper*).

The subsidies should be linked to clear commitments from the companies being established, such as contributions to regional value creation or commitments to jobs – this is also stipulated in the EU's Temporary Crisis and Transition Framework (TCTF). Such requirements should allow some flexibility in light of unforeseen market developments but are necessary to ensure the effectiveness of taxpayer money spent (for recommendations on specific value creation areas for settlement support, *see field of action 3*).

4.2 Area of action 2: Enabling sustainable productivity growth and innovations with networked value creation, a new production paradigm and scaled core technologies

The entire ecosystem of the German automotive industry must significantly increase its productivity. Only in this way will it remain internationally competitive in the medium to long term. For sustained high productivity growth, there must be a stronger focus on the development and deployment of forward-looking core technologies, as well as accompanying skill development for the workforce (*see also the Scientific Advisory Board of the BMWK 2022*). The ETA outlines a strategy with three analytical levels: value creation, factories and technologies while highlighting software as a cross-cutting issue of particular importance:

SHARED VALUE CREATION

\ **Expand regional and digitally connected value creation and technology clusters: T**he productivity development of the automotive industry's value chains is based on close cooperation among companies in regional clusters (see examples in Baden-Württemberg, Bavaria and Lower Saxony). The transformation of the automotive industry now requires the restructuring, expansion and creation of these clusters, taking into account the changed framework conditions and the opportunities provided by digitalisation. The aspect of productivity development must play a key role here. Value creation processes, the necessary technologies and data spaces must be orchestrated, built and operated.

The **government** is called upon to support this process through funding, an appropriate legal framework and stable conditions to stimulate investments. The priority must be the establishment of highly productive and thus competitive value creation clusters (*see the paper on structural policy measures of ETA*).

\ **Create technological sovereignty in competitively differentiating production technologies: T**he development of new value creation areas, such as the production of semiconductors, battery cells and systems, as well as other components of the electrified powertrain and autonomous driving, is central to maintaining sovereign value creation in Germany. This includes, above all, sovereignty (control over intellectual property) for the necessary and competitively differentiating production technologies and their systemic integration into highly productive and sustainable factories. Research funding must focus more specifically on production aspects in these fields. Companies and suppliers should develop strategies to become internationally leading in at least certain aspects. A prominent example of this success is seen in semiconductor manufacturing equipment, with Trumpf lasers and Zeiss optics. This success story should now be consistently applied to all relevant areas, such as battery cell production.

\ **Make data-based technologies available for significant productivity improvements:** The use of data-based systems holds great potential for increasing productivity. All data generated during the traditional value creation process in factories and across the entire value chain must be used by companies to rapidly accelerate improvement and learning processes. The results that can be achieved depend on the quantity and quality of the data, as well as the availability of high-performance infrastructure and AI technologies.'

The **government** is called upon to create all necessary regulatory and normative frameworks for the monetary use of this data. Initiatives like GAIA-X and projects such as Catena-X or Manufacturing-X lay the foundation for the seamless networking of the supply chain. A consistent implementation (technologies, standards, protected IP vs. open source) within the industry's value chains is another component of sovereign value creation. Projects like Catena-X and Manufacturing-X must continue to be supported and strategically guided to ensure their swift implementation. Government support should especially focus on small and medium-sized enterprises, as these are where the highest productivity potential is likely to be found.

HOLISTIC FACTORY

- **Electrification, digitalisation and automation for holistic production systems: A** revolutionary approach to GPS 4.0 (Holistic Production System 4.0) is necessary to enable further leaps in efficiency regarding productivity and environmental neutrality in automotive production. The electrification and digitalisation of both the vehicle and the production technology (Software Defined Vehicle and Production) open new areas for innovation that must be leveraged to achieve productivity gains and implement sustainable new production systems. The vehicle architecture, including modular design, can be made more production-friendly. Additionally, the vehicle itself becomes a production tool. The vehicle's independent mobility (e.g., moving from one process to another autonomously) and its software-defined capabilities (e.g., sensor data) can be utilised. Furthermore, already developed Industry 4.0 technologies (such as digital twins, human-robot collaboration, PredictiveX, etc.) and new approaches in artificial intelligence (e.g., GenAI) should be integrated into a GPS 4.0. Lean production principles should continue to be applied where compatible. The government should support such developments in companies. This new production system can only be developed collaboratively as a joint effort of the automotive industry. Competitive legal frameworks must be established and start-up funding should be provided. Additionally, SMEs should be supported – for example, more flexible depreciation options for automation or digitalisation costs could increase the willingness to implement these changes quickly and comprehensively.

- **Engineering processes must be consistently automated:** Complex factory systems require comprehensive engineering processes. For automation in production, high levels of engineering performance are needed for development, implementation and operation. Especially for small and medium-sized enterprises, it is often difficult to implement meaningful solutions due to the costs of implementation or the lack of skilled workers. AI concepts, particularly Generative AI (Co-Piloting), already show potential for partial or complete automation of engineering processes. This can unlock productivity in two ways: firstly, by automating engineering itself and secondly, by the results of these cost-effective engineering processes, which enable the automation of value creation. The government should initiate flagship projects to make the necessary technologies and processes quickly available to companies. The automotive industry, with its technology affinity and high automation pressure, would be particularly suitable as a testing environment (*see action sheet 3 – Automation of Engineering Processes in the Appendix*).

PRODUCTIVITY-ENHANCING AND DIFFERENTIATING CORE TECHNOLOGIES

Some core technologies make a particularly significant contribution to the sustainable increase in productivity in the automotive industry. These technologies not only have an impact in the factories but also, as separate fields of innovation, contain the potential to establish new globally successful business areas for existing companies or start-ups. The government should develop innovation-promoting strategies for these technologies together with the automotive industry as a partner and quickly implement them in the form of SME-oriented transfer clusters:

- **Robotics:** In particular, the use of robots can further optimise manufacturing and improve working conditions within production at SMEs and suppliers. The funding opportunities, especially in the SME sector, should be significantly improved to enable a much wider deployment. Germany must become a lead market and a leading provider in robotics. In the industrial application area, the automotive industry, due to its current level of automation and the potential of the ongoing transformation, offers an opportunity to become a reference for the entire industry in Germany (*see action sheet 4 – Intelligent Robotics and Automation in the Appendix*).

- **Digital twinning:** The use of digital twins offers significant potential for increasing productivity. The term "digital twin" encompasses numerous technologies and concepts necessary for implementing the overall concept of connected production. This includes the Industrial Metaverse, asset administration shell, autonomous systems, as well as Real-Time Localisation Systems (RTLS) or Cloud-Edge architectures in infrastructure. Many companies in the automotive industry are already working on implementing these concepts and should be supported in the development of corresponding concepts.

- **Circular economy:** The transformation of the automotive industry presents the potential to create a sustainable circular economy. This is crucial to minimise the environmental impact of vehicles throughout their entire lifecycle, conserve costly raw materials, recover valuable materials and extend the usability of vehicles over a long period. Some of the pioneering recycling technologies in the automotive industry include automated dismantling, battery recycling and technologies for recycling composite materials (*see action sheet 7 – Securing Raw Material Supply for Batteries and Establishing Battery Circular Economy in the appendix*).

FOCUS: INNOVATION AND PRODUCTIVITY THROUGH SOFTWARE AND AI EXPERTISE

\ **Expand software development expertise in companies, workforce and management:** The appropriate reuse and adaptation of software, as well as the updatability of software in operations, enable increased development productivity and shorter development cycles. New vehicle architectures, the connectivity of vehicles and the integration of mobile devices for customers require agile development processes and collaboration models between software manufacturers and the automotive industry. To unlock this potential in software, all companies in the automotive value chain need software development expertise within their workforce and at all levels of management. The government should support this transformation towards more software competence in companies by providing appropriate funding for research and development, as well as training and education programmes.

\ **Strengthen Open Source Software (OSS) networks and promote collaborative software development:** The increasing scope and complexity of software can only be managed by individual companies with significant effort. Therefore, a concept has been developed (in preparation for a European funding project) to collaboratively develop non-differentiating software elements in a pre-competitive environment using an Open Source approach. This method can significantly increase efficiency, speed and thus development productivity in automotive software development. At the same time, collaborative Open Source development is a competition- and innovation-friendly foundation for the Software-Defined Vehicle, helping to maintain Europe's leading position in the global automotive industry. The German government should consistently support these activities and avoid hindering them with regulations that have side effects. The focus of a European Open Source initiative should include reusable software components on an Open Source basis, open interfaces with carefully managed APIs, contributions to hardware and software abstraction layers, software solutions both in the vehicle and in backend and cloud, as well as shared tools and toolchains for development, simulation, integration and testing.

\ **Productivity increases through Artificial Intelligence:** Generative AI should be used in areas of the automotive ecosystem to support and automate development and production processes (e.g., co-pilots for production). Automation approaches in indirect and administrative areas can drive efficiency improvements for both manufacturers and suppliers. To achieve this, an analysis of the true potential of AI applications and their risks beyond the current AI hype is necessary. For the application of AI methods in production and development, the government must create framework conditions that ensure secure data exchange. Additionally, the development of data privacy-compliant and data-efficient AI, as well as privacy-protecting AI, is crucial. For particularly powerful AI models, the required AI computing infrastructures must be established. The development of national computing power and energy-efficient, sustainable AI should be supported. In addition to the pure application of AI methods from the USA and China, there is also a need to fund AI basic research and build up European AI expertise.

\ **Build design and production competence for semiconductors:** Semiconductors will be a key foundation for core technologies, products and processes in European industry in the future. Given the importance of semiconductors, especially for the automotive and mechanical engineering sectors, it is strategically important to invest more in the semiconductor value chain. First, the supply of chips for the production process itself must be secured, as the increasing use of AI-based production and quality-monitoring systems raises the demand for high-performance chips. Additionally, with the introduction of direct current technology in production, coupled with directly generated and stored renewable energy, the need for power electronics and the associated chips will also increase.

Second, German car manufacturers should closely align the semiconductors they source with their own production. By developing semiconductors collaboratively with partners tailored to their specific needs, car manufacturers will become more competitive in many core aspects of modern vehicles. Functions of autonomous driving and other digital applications perform significantly better when the semiconductors used are custom-designed for the vehicle and operating system. The business model of the new chip factories by TSMC in Dresden focuses on the production of collaboratively developed chips. In other application areas, it may make sense to use generic chips as a hardware platform. The government should continue to constructively support the development of semiconductor value chains, including research and development, as well as training and education (see the section on semiconductors in area of action 3).

4.3 Area of action 3: Building key areas of new value creation and integrating them into the German automotive ecosystem

The new areas of automotive value creation must be represented within Germany. However, not every aspect of the complex value creation processes needs to be fully contained in Germany. Instead, industry and the federal government should identify and strengthen "critical points" based on clear criteria (*see area of action 1*) to position Germany as an attractive international partner with strong negotiating leverage (similar to the EUV lithography cluster in the semiconductor sector). It is sufficient to have global champions in certain niche areas. In the following it is discussed which critical points these might be:

SEMICONDUCTORS

The automotive industry relies on a wide range of different semiconductors – from power semiconductors for controlling electric drivetrains to leading-edge chips for AI applications. New chip factories in Germany reduce dependence on imports and foster innovation through close collaboration between chip manufacturers, automotive suppliers and OEMs. However, additional steps are needed to further reduce supply risks, boost innovation and enhance value creation:

- Any production along the entire semiconductor value chain is welcome in Germany and Europe. However, particular focus in site selection should be placed on frontend fabs and backend fabs for mature chips and leading-edge chips.
- For the automotive industry, it is beneficial to further enhance its supply chains through long-term supply contracts and collaboration and planning across the entire value chain – including and especially, with foreign semiconductor producers. Within the scope of antitrust regulations, cross-company and even cross-industry collaborations, processes and platforms can also be developed to increase supply security (*see Industry Advisory Council*).
- For Germany, it is also important to occupy strategically significant parts of the semiconductor value chain as a technology leader. This not only creates dependencies of international partners on Germany but also allows Germany to negotiate from a position of strength through its own contributions.
- Particular emphasis should be placed on critical parts of the value chain that are especially significant for the automotive industry and where Germany already holds a strong competitive position internationally. Key areas include:

  - Chip design, which is particularly important for the precise alignment of hardware and highly specialised software applications, such as AI or automated driving applications.
  - The open-source architecture RISC-V, which is on the verge of becoming a quasi-standard. This versatile instruction set architecture can be used in microcontrollers, central computers, zone controllers and in sensors with measurement evaluation (smart sensors).
  - Power semiconductors, which are important for controlling and switching high electrical currents and voltages in BEVs. For example, there is ongoing work on silicon carbide semiconductors with improved properties.
  - Sensors and EUV lithography, in which Germany and Europe, with the collaboration of ASML, Trumpf and Zeiss, already play a leading role (*see the ETA Semiconductor Paper and the production-related section on semiconductors in area of action 2*).

AUTOMATED AND CONNECTED DRIVING AND ARTIFICIAL INTELLIGENCE

German automakers and suppliers are leaders in driving systems for automation levels 2 to 3, while commercial services at level 4 are currently only offered by Chinese and US players in their home regions. In Germany and Europe, there are numerous pilot projects, though most are still at a low level of maturity. To achieve a sustainable, autonomous and connected mobility and transport system, both politics and business must be active in four key areas (*see action sheet 5 – Advancing automated and connected driving in the annex*):

- To strengthen vehicle and infrastructure technology, it is recommended that digital data about the traffic environment is made available to all road users in a timely and reliable manner. For the functional validation of automated driving systems, it is advised that scenario-based testing based on scenario databases, reference frameworks for virtual toolchains and the homologation of software updates for safety-critical driving functions be advanced across the board. Continuing the targeted promotion of pre-competitive, cross-manufacturer research in key areas is also recommended. Furthermore, cooperation between actors from industry and research should be expanded at the European level. Harmonised standards can make the development and implementation of ACD systems in Europe faster and more efficient.

- A reliable legal framework for ACD (Automated and Connected Driving) must be established. The existing European legal framework should be extended to mass production to enable scaling. Early clarification of the guidelines for the expected design of sector-specific AI regulation in the automotive sector under the EU AI Act would be desirable.

- The benefits of ACD should be widely communicated to foster societal acceptance. Traffic safety and energy efficiency should be the main focus. To achieve this, a joint approach from industry, politics and operators should be developed for citizen, opportunity and risk communication.

- Stakeholders in Germany should focus on scalable business models. A practice oriented approval process for ACD operational areas, which adopts tests from other comparable operational areas when approving new ones, would be helpful. Additionally, it is recommended to initially limit the focus to traffic-wise simple operational areas (e.g., intralogistics or public transport) with subsequent gradual expansion. The accelerated implementation of dual-mode vehicles, which can operate automatically within certain operational areas and manually outside of them, is also advisable.

BATTERIES

The looming loss of one-third of the value added in BEVs due to the "late start" of the German industry in battery cell development and manufacturing requires comprehensive measures. These measures must leverage Germany's leading positions in areas such as machinery and plant engineering, as well as sustainability, to unlock the value-added potential in BEVs and thus avoid a loss of value in battery production.

- The research funding must be restructured: A coordinated battery research strategy, aimed at the development of new cell chemistries and material substitution (Technology Readiness Level/TRL 1-4), must plan the entire development path up to production technology (TRL 8) from the outset and also support the optimisation of this production technology during industrialisation. German equipment suppliers must be enabled through targeted application research to gain competitive advantages by improving production facilities for existing technologies. These competitive advantages can be realised by significantly reducing scrap rates and the need for materials and energy (*see action sheet 6 – Strengthening battery cell research and manufacturing in the appendix*).

- The development of technologies for the recycling of battery cells, i.e., during the disassembly of vehicle batteries, recycling of raw materials and the use of recycled materials (*see ETA paper on innovations, ETA paper on raw materials*), promises a further competitive advantage in view of the expected regulations at the European level (*see McKinsey 2023*). The promotion of innovative approaches in sustainability (recycling/circular economy) as a prerequisite for corresponding IPCEIs and an extension of European legislation on repair to include the traction battery of a BEV could further strengthen this (*see action sheet 6 – Strengthening battery cell research and manufacturing in the appendix*).

- Special attention should be given to promoting the development of technologies for the "direct recycling" of battery raw materials, i.e., the direct use of "black mass," as there are significant potentials for energy-efficient reuse of valuable raw materials (*see IW / EY / BMWK 2024 study* as well as action sheet 7 – Securing raw material supply for batteries and building a battery circular economy in the appendix).

- The industry should build development partnerships along the battery system supply chain to particularly relieve SMEs from the high innovation costs. Corresponding legal frameworks are the necessary prerequisite.

All efforts to establish battery production in Germany would be in vain if the European Commission proceeds with its plans to introduce a paradigm shift in the environmental assessment of batteries under its revision of the Battery Regulation. Accordingly, it aims to base the calculation of the CO_2 footprint of battery production on the national electricity mix. Furthermore, it plans to no longer accept renewable energy certificates, which companies have previously used to prove their demand for electricity from renewable sources. Due to Germany's current high share of electricity from fossil fuels and its exclusion of nuclear energy, this would make it de facto impossible to meet the CO_2 cap for battery production (x kg CO_2/kWh battery capacity) starting in 2027, thus jeopardizing battery production itself. The ETA therefore urges the German government to influence the European Commission to ensure that a fair and EU-wide competitive solution is found for the environmental assessment (e.g. by using the EU-wide electricity mix or through stricter requirements for electricity certificates than before).

FUEL CELLS AND HYDROGEN

Due to the potential for hydrogen-based drive technologies to complement battery-electric drives in specific applications, research and development in this area should continue to focus on concrete applications by the industry and be supported by the federal government through technology-neutral research programs. In an internationally highly dynamic environment, a potential key technology in the field of research and development should not be excluded.

SUPPORTING THE RAMP-UP OF NEW DRIVE TECHNOLOGIES MORE STRONGLY

- The current weakness in the market ramp-up of electromobility, which is only observed in Germany in this form, represents a significant threat to the location in many respects. While higher specific profits can be made in the short term with combustion engine models, small volumes of battery electric vehicles prevent and delay investments and economies of scale in this future market. This implicitly weakens Germany's competitive position compared to US or Chinese competitors.

- The government should therefore continue to actively seek opportunities to stimulate the ramp-up of electromobility, following the cancellations in recent months. It is essential to send clear signals for the planning security of companies, aiming to achieve the politically set targets of putting 15 million battery electric cars and light commercial vehicles (LCVs) on the road in Germany by 2030 and to handle one-third of road freight transport with electric drives. These goals are of great importance both for the industry and for climate policy.

- The announced special depreciation for the purchase of fully electric vehicles with batteries or hydrogen fuel cells by companies is a good first step (*see EStG § 7c Special Depreciation*). Efforts should be made to also include leased vehicles. Additionally, the implementation of the fuel station supply mandate, which requires large fuel station companies to set up fast charging points and the implementation of the EU Building Directive (*see Directive (EU) 2024/1275, Article 14*) should be pursued ambitiously. However, individual measures alone will not be sufficient to achieve the electromobility goals. What is needed is a coherent overall concept that combines a mix of regulatory law, fiscal/economic incentives and infrastructure investments, ensuring they are effectively, efficiently and socially fairly integrated. Without such a comprehensive approach, the 2030 goals will become unattainable and jeopardise the climate neutrality of the transport sector by 2045.

- When setting goals and implementing measures, the consumer perspective must be given greater consideration. The reluctance to purchase electric vehicles is also linked to consumer uncertainty, particularly regarding the government's ambitious goals for charging infrastructure, without deploying the necessary resources to meet those targets. Therefore, it is crucial that the "Master Plan Charging Infrastructure II" is now implemented in a timely and consistent manner. This includes the implementation of Measure 47 of the Master Plan. This measure aims to make bidirectional charging simple, safe and non-discriminatory (*see National Coordination Center, Paper on Measure 47, 1/2024*).

- In addition to the development of an attractive charging infrastructure and the availability of renewable energy for charging, an electricity price is necessary that makes the operation of electric vehicles sufficiently cheaper than that of internal combustion engine vehicles. This can be achieved through tax measures and ensuring a competitive offer of charging electricity.

- To rapidly and efficiently decarbonise road freight transport, the federal government should now intensify its efforts to establish an initial charging network for battery-electric trucks. This expansion should have clear priority at this stage as part of a no-regret approach and the existing market readiness and economic conditions leave no doubt that this drive will see widespread application in the future. Demand is steadily growing already. The rapid market ramp-up of battery-electric commercial vehicles should now be pursued with the highest urgency, both for industrial policy reasons and for climate protection. To accelerate the uptake of battery-electric trucks, consideration should also be given to replacing the lost purchase subsidies for logistics companies with new financial incentives.

- The EU Regulation on the establishment of infrastructure for alternative fuels (AFIR), which has been in effect since April 2024, includes targets for the expansion of hydrogen refueling stations by the end of 2030 (*see Regulation (EU) 2023/1804*). Among the members of the ETA, there are different assessments of AFIR:

  A part of the expert group supports a consistent and ambitious implementation of the AFIR by the German government, especially in regard to the refueling station network. The global market ramp-up of low-carbon hydrogen production is seen as an opportunity to achieve CO2 targets in heavy-duty vehicle (HDV) traffic through an EU-wide hydrogen refueling network. The availability of green hydrogen in sufficient quantities and the expansion of the refueling infrastructure for trucks and buses is central to this goal and a corresponding strategy for HDV traffic is being pursued in many countries. Germany, with its technological leadership, should complement this attractive export market with a nationwide domestic market. Therefore, the development of this sector should be continued ambitiously by the industry and equally supported politically.

  Another part of the expert group recommends accompanying the implementation of the AFIR with a continuous review of the hydrogen infrastructure requirements based on current scientific insights into key parameters (technological development, price trends for vehicles, electricity and green hydrogen, raw material markets). Relevant findings, particularly regarding the overall costs of hydrogen trucks, should be presented by the German government in the mid-term evaluation planned for the end of 2024, as well as in the 2026 review of the regulation at the European level. In any case, it must be ensured that the development of hydrogen refueling infrastructure does not come at the expense of building charging infrastructure (LIS) for battery-electric trucks.

DATA-DRIVEN BUSINESS MODELS

The increasing digitalisation of vehicles and mobility infrastructure enables new business models, such as Mobility as a Service, through networking and increased data availability. These models can make mobility safer, more sustainable and customer-oriented. Furthermore, there are potential business models arising from the energy-based marketing of vehicle batteries.

- Comprehensive data availability and networking require much stronger collaboration between OEMs, suppliers, service providers, infrastructure providers and other stakeholders in the mobility ecosystem. To specifically ease the integration of various systems, automotive industry players should work together to develop software based on open-source architecture. This allows for the rapid establishment of code-based quasi-standards. Standardised data formats with common semantics and syntax facilitate and accelerate data exchange.

- Standardised in-vehicle app platforms would make app development faster, more attractive for third-party providers and the apps more user-friendly. To achieve this, OEMs would need to standardise the platforms offered in their operating systems across manufacturers and equip them with comparable interfaces and data availability (similar to iOS and Android in smartphones).

- To invest in data availability and connectivity, companies need protection for their intellectual property, such as algorithms and aggregated data, which arise from these investments.

- At the same time, transparency regarding data usage and the resulting added value is needed, along with a sovereign decision on data sharing. Implementing both directly at the data source is crucial to increase acceptance of data sharing.

- To enable fair and equal data access for all participants, cross-sector data marketplaces are needed, which should be linked with data marketplaces from other sectors, ideally on an international scale. Data marketplaces should be implemented as federated, decentralised and collaborative data ecosystems to ensure data sovereignty and privacy, while enabling purpose-driven data use.

- Bidirectional charging offers the opportunity to provide grid-supporting flexibility, where various vehicle batteries are marketed as a virtual power plant. However, regulatory frameworks are currently lacking for distribution system operators to utilise such flexibility.

CONCLUSION AND OUTLOOK

The expert group has chosen the fundamental and timely topic of the future of automotive value creation in Germany. The automotive industry has increasingly been in the political spotlight for some time now. The ETA identifies three key areas for the future of automotive value creation in Germany:

1. improving factors of competitiveness as the foundation for greater competitiveness and innovation,

2. a paradigm shift to a holistic production system, including the scaling of core technologies in production facilities and

3. the targeted development and expansion of key areas of new value creation and their integration into the overall ecosystem of automotive value creation.

These areas are based on extensive analyses that take into account various perspectives from both science and practice. The ETA derives specific recommendations from these key areas.

The transformation of the automotive industry in Germany has been and will remain an ongoing dynamic process. Key technologies for the car of the future, such as autonomous and connected driving or alternative drivetrains, are far from being fully developed and their evolution can only be partially predicted. Moreover, German politics and the companies producing in Germany do not operate in a vacuum. Embedded within the European Union, geopolitical relationships and a global market, Germany's strategy must be regularly adjusted in light of the activities of international players.

In this context, a comprehensive overarching concept is required to link the individual measures in an effective, efficient and socially just manner. The recommendations presented in this paper by the ETA are therefore broad-ranging; together, they outline a path for ensuring the future of automotive value creation in Germany. However, the challenges are pressing and the recipients of these recommendations from politics and business are required to address them through a collective effort.

APPENDIX: ACTION SHEETS

6.1 Action sheet 1 – Reducing bureaucracy

RELIEVING BUSINESSES THROUGH THE SIMPLIFICATION OF ADMINISTRATIVE PROCESSES AND THE REDUCTION OF BUREAUCRATIC OBLIGATIONS

Challenges and goals

Numerous reporting and information obligations without any discernible added value burden companies in the automotive industry, particularly small and medium-sized suppliers. The *Bureaucracy Relief Act IV (BEG IV)*, which has already been initiated, provides some relief but is insufficient to significantly reduce the bureaucratic burden.

Approach / Benefits

With a set of highly specific measures that complement the BEG IV, companies will be relieved of reporting and information obligations and administrative processes will be simplified.

Reference points of existing regulations / Initiatives / Other relevant elements

Measure 1 must be implemented through Germany's representation in international bodies, particularly within a subcommittee of the United Nations (UNSCETDG) and the working structures of the International Maritime Organisation (IMO), specifically the Sub-Committee on Carriage of Cargoes and Containers (CCC). The proposed Measures 2 to 13 reference the Federal Government's Bureaucracy *Relief Act IV (BEG IV)*. The path already taken toward reducing bureaucracy should be further pursued.

Costs / Compliance efforts

for politics and administration:
low

for industry:
cost reduction expected

Timeline

relatively short-term implementation possible, with measure 1 taking a maximum of 2-4 years.

Complexity level

low, with measure 1 requiring international coordination.

Challenges in implementation / Critical success factors

Die Maßnahme 1 setzt ein Engagement der Bundesregierung in internationalen Gremien voraus. Die Maßnahmen 2 bis 13 machen eine voranschreitende Digitalisierung der deutschen Verwaltung erforderlich.

Recommendations for concrete next steps:

1. **Simplification of dangerous goods regulations:** The current trend of increasing regulations, restrictions and bans (particularly for the transport of lithium batteries and battery-powered vehicles) is undermining the original protective goals of these rules. These regulations result in significant limitations on the exchange of materials and hinder innovation in vehicle development. Representatives of national authorities should advocate more strongly in international forums (working groups of the United Nations – UNECE TDG – and the International Maritime Organisation – Carriage of Cargo and Containers) for transparent, traceable and easily applicable regulations. For this purpose, national authorities should be adequately equipped and supported (both materially and in terms of personnel).

2. **Simplification of charging infrastructure on company premises:** Operating charging stations in company parking lots for employee use becomes a bureaucratic challenge, especially when companies wish to power them from their own photovoltaic (PV) systems. If vehicles are charged from a company-owned PV system, the company becomes an energy producer (§ 74a EEG 2017), with extensive reporting and documentation obligations. According to the Renewable Energy Sources Act (EEG), charging station operators are considered electricity suppliers when the user is a third party. A more practical solution would be to define charging station operators as end consumers rather than electricity suppliers, as outlined in the Energy Industry Act (EnWG). Additionally, the current electricity tax law leads to double taxation and substantial organisational burdens in such cases. The ETA welcomes the fact that the German Ministry of Finance (BMF) is currently working on simplifications in this regard.

3. **Facilitating connections to energy parks:** When companies currently seek a direct connection to an energy park, a challenge arises in ensuring that the public electricity grid (including within a substation) is not used. Utilizing existing infrastructure would result in significant additional costs due to extra grid fees. As a result, companies often have to invest in building their own infrastructure in parallel. It should be examined whether, for certain cable lengths, it might be possible to use the public grid to establish a connection instead of building a new one. Another consideration would be to allow a defined number of companies near the connection point for each energy park.

4. **Reducing administrative burdens from energy reporting:** Companies with an average annual total final energy consumption of more than 7.5 gigawatt hours over the last three completed calendar years are required to implement an energy or environmental management system according to Section 8(2) of the German Energy Efficiency Act (EnEfG). These companies must then have comprehensive energy and heat monitoring systems in place. Both large and small companies need an energy management system (EMS) in compliance with DIN EN ISO 50001 or an environmental management system (EMS) according to EMAS. Additionally, the energy and environmental management systems must meet further requirements (e.g., recording energy flows).

   These extensive additions should be reduced, especially to make them feasible for smaller companies and ensure they provide clear added value.

5. **Automating the reporting of electricity tax relief:** The currently required manual reporting of tax relief, particularly under Section 9b of the Electricity Tax Act (StromStG), could be avoided if the main customs office optimised its communication and automatically generated the report. This would increase efficiency and reduce the administrative burden for companies. A similar approach should be considered for compensation of electricity price subsidies and other energy cost reductions (electricity tax, KWKG levy, offshore grid surcharge, individual grid charges according to StromNEV, load data collection by the Federal Network Agency).

   An automation of the report on the (electricity) tax relief received during the calendar year under Section 5 of the Energy Tax and Electricity Tax Transparency Regulation (EnSTransV) to the main customs office should be introduced.

6. **Lifting the purpose limitation for the use of requested data:** To reduce the high compliance effort for official statistics and companies, the purpose limitation for the use of requested data, which currently restricts multiple uses, should be removed.

7. **Avoiding duplicate reporting in Intrastat declarations:** In the context of Intratrade statistics reports, there is a double reporting of consignors and recipients to the Federal Statistical Office.

   It is proposed to adapt the procedure to the "single stream" method, similar to the summary report (ZM declaration, VAT law), so that only the consignor, who is most familiar with the goods, reports the required data regarding quantity, sales value and commodity group. Subsequently, the collection of goods arrivals would be fully or partially waived and instead, mirrored shipping data from partner countries, exchanged between member states, would be used. It would be up to the member states how to use the shipping data from partner countries. This single stream procedure is not currently provided for businesses in the German law for the implementation of the Intratrade statistics amendment.

8. **Abolish unnecessary reporting requirements for export declarations:** The additional requirement to specify the exporter defined under foreign trade law (§ 12 Abs. 3 S. 3 AWV) or the Dual-Use Regulation in the export declaration creates significant additional effort for many companies (coordination efforts with business partners). Furthermore, this requirement disadvantages German businesses within the European Union, as no similar customs regulations exist in other EU countries. No identifiable added value is created by this specification. Therefore, the reporting obligations in export declarations should be abolished.

9. **Remove requirement for vehicle registration number in export declarations:** Since December 1, 2023, the requirement to include the vehicle registration number in export declarations has been introduced. Currently, companies often enter "xx-xx-0000" in the field to indicate that they do not yet have this information. The relevance of this requirement should be reviewed and it should be removed if it provides minimal value.

10. **Switch to a credit model for import VAT:** Although European law provides for the offsetting of import VAT, the tax is currently due at customs when goods are imported into Germany. A refund can only be obtained via the VAT pre-filing with the tax office. This leads to disadvantages for the location due to administrative costs for the refund process and liquidity burdens due to interim financing costs. Therefore, the option provided in Article 211 of the EU VAT Directive 2006/112/EC to introduce the so-called credit model should be utilised. In this model, the tax is reported in the VAT pre-filing and the import VAT is deducted as input tax in the same process.

11. **Simplify payment reports Z4 and Z5a2 with the Bundesbank:** Statistical data, for which there is a legal reporting obligation under §§ 67 ff. of the Foreign Trade and Payment Regulation (AWV), is required by the Deutsche Bundesbank for the creation of the German balance of payments. Companies must submit data on incoming and outgoing payments, as well as receivables and liabilities from financial relationships with foreign non-bank entities. However, the banks involved should already have this data since they conduct the transactions.

    A simpler approach would be direct communication between the banks. They could then ask for further clarifications if needed, in line with anti-money laundering regulations.

12. **Digitalise employment contracts:** The Proof of Employment Act includes outdated requirements such as the need for signatures and paper forms for employment contracts, leading to additional effort and costs for companies.

    A practical approach, already standard in other areas for applicants, is the simple transmission of employment contracts in text form with proof of submission and receipt. This can be implemented easily and cost-effectively. The same should apply to contract amendments, such as salary increases.

13. **Waiver of written form in automotive financing:** In the area of digital automotive financing agreements, the loan contract is concluded through two corresponding declarations of intent (offer and acceptance). According to Section 492(1) in conjunction with Section 126a of the German Civil Code (BGB), electronic form is allowed for the consumer's declaration of intent. However, the automotive financial service provider, as the lender, can waive the handwritten signature as long as the declaration is made using an automated system. The current legal situation, however, requires that the declaration still be printed (proper submission of the acceptance statement).

    It is therefore proposed that the financial service provider be allowed to agree with the customer to waive the written form for the submission of acceptance. A more practical approach would be for the lender's acceptance statement to be in text form.

6.2 Action sheet 2 – Simplify grant applications and administration:

MORE EFFECTIVE USE OF TAX FUNDS IN LINE WITH FUNDING PURPOSES THROUGH SIMPLIFICATION AND FLEXIBILISATION OF GRANT APPLICATIONS AND ADMINISTRATION

Challenges and goals

With a clear consensus that tax funds must be spent responsibly, it becomes evident that the administrative processes involved in funding projects are too complex and time-consuming, tying up significant resources. Clarifying detailed questions takes a lot of time and, in the worst-case scenario, can put the entire implementation of the funding project "on hold."

The interpretation of funding rules can lead to differing interpretations and thus varying levels of funding flexibility across different projects. Examples include differing approaches to allowable personnel use, the unlocking of already approved, eligible expenses, the carryover of budget funds to the following year, or the requirement to enter into new lease agreements for a project.

As the BMWK (Federal Ministry for Economic Affairs and Energy) itself points out in its Industry Strategy, there is an urgent need for the bureaucratisation of the application process to be reduced, as well as for easier access to funding programmes (*see BMWK Industry Strategy 2023*).

Approach / Benefits

The project sponsors (or the ministries that publish the guidelines) should trust a grant recipient to adequately implement the decisions underlying a grant approval. At the same time, they should grant the grant recipient more autonomy in decision-making during the implementation of the grant approval, while adhering to the prescribed financial framework.

The current approach leads to micromanagement by the project sponsors and a significant variation in the level of detail in queries among individual staff members. This creates legal uncertainty and repeatedly causes significant delays. Although simpler requirements for evaluation, procurement law, fund reallocations and personnel time tracking are desirable, it becomes clear that the conventional method – creating more comprehensive manuals and additional provisions for grants that describe and clarify every individual case – does little to solve the problem. On the contrary, like in tax law, they create new interpretative space, leading to further legal uncertainty. Only the combination of simpler requirements and the above-mentioned approach, which gives applicants more decision-making autonomy during the implementation of the grant approval, will lead to effective acceleration and simplification of the process and project implementation.

The recommendations aim to focus the work of the grant recipients more on the project objectives, avoid bureaucracy and reduce time-consuming ambiguities.

Reference points of existing regulations / Initiatives / Other relevant elements

- The feedback from both the ETA hearing and the surveys conducted by ETA within the transformation networks and further education associations have shown that the speed and quality of the substantive work, e.g., in the transformation regions funded by the BMWK, are heavily dependent on time-consuming administrative conditions.
- The currently required precise advance planning of financial resources for travel expenses at the start of the project leaves little flexibility during the project. This makes it difficult to respond to analytical insights and develop a learning curve, preventing the funds from being used in the best possible way to achieve the objectives. [6]

6 For an in-depth problem analysis and further recommendations for action from the stakeholders, also refer to the report on the Transformation Dialogue of the Automotive Industry from 2020: https://www.bmwk.de/Redaktion/DE/Downloads/S-T/transformationsdialog-automobilindustrie-bericht.html.

Costs / Compliance efforts

or politics and administration:
low

for industry:
no costs

Timeline

as soon as possible

Complexity level

low

Recommendations for concrete next steps

- The project implementation should be more focused on overarching objectives and less on detailed, long-term project and financial plans. To achieve this, a corresponding structural reform in project management could help, one that focuses more on implementation results and goal achievement rather than on plan fulfilment and budget allocation.
- Administrative processes (such as those related to tenders and procurement) should be further streamlined and de-bureaucratised, so that funding recipients can focus on their core tasks. The provision of uniform, publicly accessible and simple guidelines for evaluation requirements, procurement law, budget reallocations and personnel time tracking is desirable.
- A working group consisting of representatives from the BMWK and the project sponsor VDI/VDE-IT should be established to propose simplification options within the framework of the applicable funding and administrative law over the next six months (demand from the ETA position paper on *recommendations for structural policy measures for the transformation of traditional automotive regions,* 2023).
- Funding databases should be improved to enable faster and more targeted identification of programs. For example, the website *www.foerderdatenbank.de* is a useful tool but still needs improvement in terms of completeness, user-specific filter terms, overlapping categories when filtering and search functionality.
- Funding gaps for growing companies, which arise from limiting the eligibility of programs to companies according to the European SME definition, should be closed.
- To accommodate companies during times of fluctuating prices and uncertain delivery dates, the deadlines for submitting proof of expenses could be made more flexible. This would allow companies to better plan and document their expenditures.

Especially with regard to funding for the creation of production capacities for transformation-relevant technologies, which is facilitated by the new EU Crisis and Transition State Aid Framework (Temporary Crisis and Transition Framework), future funding could follow the US IRA methodology alongside the existing funding methodology. The current system requires an extensive application for funding for an initial investment, with a fixed funding ceiling and uncertain approval.

Under the IRA framework, companies can choose between a one-time funding amount for the initial investment (e.g., the construction or expansion of a production facility) or funding for the subsequent production itself (e.g., x $ per kWh of battery capacity produced or x $ per kilogram of hydrogen produced). The latter approach may be more beneficial for companies, as the funding application is simpler, approval is guaranteed when the funding criteria are met and it also covers operational costs. The IRA funding model prioritises planning security for companies, while the EU model offers greater planning certainty and control for the state (*see SVR Policy Brief 1/2023*). However, this would also require adjustments to EU state aid law.

6.3 Action sheet 3 – Automation of engineering processes

Challenges and goals

To maintain international competitiveness, the entire German automotive ecosystem must significantly increase productivity. At the same time, it is becoming evident that the shortage of skilled workers – particularly in engineering – will continue to intensify.
The goal must be the automation of engineering processes. This is especially an opportunity for SMEs to optimise their processes and make the most of the potential offered by digitally connected value chains.

Approach / Benefits

The government should initiate flagship projects for the use of automated engineering processes. Generative AI, particularly as FOSS (Free and Open Source Software), should be a focal point in this context. This approach would enable the necessary technologies and processes to be made quickly available to businesses. For SMEs, improved automation potentials, such as the more flexible use of industrial robots, offer opportunities to significantly increase their productivity.

Reference points of existing regulations / Initiatives / Other relevant elements

Existing tools for AI-supported compliance with regulations provide insight into the potential of AI-driven engineering. In particular, the support for design and process optimisation, as well as the integration with simulation systems that automatically generate models, promise significant progress in productivity.

Costs / Compliance efforts

for politics and administration:
low

for industry:
low

Timeline

medium-term

Complexity level

medium

Challenges in implementation / Critical success factors

The biggest challenge is building the necessary expertise within companies, especially among SMEs. In order to fully leverage the potential of automated engineering processes, all companies in the automotive value chain need software development skills in their workforce and at all levels of management. This need will decrease as the developed tools mature.

Recommendations for concrete next steps

The existing AI funding programs should be expanded to include a focus on using AI in engineering processes. Corresponding flagship projects could then demonstrate the possibilities in industrial engineering, taking into account the open-source approach. The concept developed by ETA, which allows for the collaborative development of non-differentiating software elements in a pre-competitive environment using an open-source approach, would support this. A necessary regulatory framework is a prerequisite for this. It is recommended to establish AI-based centres for engineering processes, based on a cross-cutting data foundation. The goal of each center is scalable software and community-based foundation models. Due to the need for data sharing, it is essential to create cooperation formats and a legal framework for the centres. The following three centers are recommended:

1. **Centre for connecting product development and industrial engineering:** The engineering of automation solutions is shaped by various domains such as process engineering, assembly planning and automation technology. With increasingly varied production and shorter product life cycles, it is becoming more complex. To gain a competitive edge, these engineering processes must be closely aligned with the corresponding product development. In order to keep automation economically viable, engineers must be supported in their work. With generative AI, a new technological opportunity arises that must be leveraged through funding guidelines for engineering in automotive production. Key topics include the layout and design of assembly lines, robot system design, automated risk assessments, compliance checks with machinery regulations and programming of automation systems/robots.

2. **Centre for highly customised production:** German car manufacturers differentiate themselves largely from competitors by offering highly customised vehicles in the high-end price segment. This leads to new challenges with regard to engineering processes. Therefore, central processes include supply chain planning, automation planning and the operation of highly flexible production systems to implement Design-to-Order processes in the automotive industry. The differences between high volumes with low variance in production and manufacturing in industrial settings must also be covered through automated engineering processes. Furthermore, automation potentials should be automatically derived, especially for manufacturing or manufacturing-like production processes.

3. **Centre for remanufacturing:** Establishment of a centre for circular automotive production for testing and developing assembly and disassembly processes. The focus of the centre should be on disassembly and remanufacturing technologies, as well as methods of design for remanufacturing. Additionally, aspects of the logistics system should be taken into account. Artificial intelligence and robotics can serve as cross-cutting technologies here. Existing research formats, such as research campuses, could serve as a model for implementation.

6.4 Action sheet 4 – Intelligent robotics and automation

Challenges and goals

Due to high labour costs and a shortage of skilled workers, Germany requires intelligent and flexible robotics and automation solutions to maintain its competitiveness in the manufacturing sector. These solutions enhance flexibility and increase productivity – sometimes even independently of additional human labour, provided new production system concepts (e.g., matrix production systems or unboxed systems) can be successfully implemented.

Approach / Benefits

Existing core competencies in areas such as robotics (including gripper technology) and automated machinery and systems must be strategically promoted in conjunction with emerging technologies like AI to drive domestic productivity growth and create exportable products. This includes the following topics:

- Technologies for humanoid robots
- Cognitive robotics
- Low-code/no-code programming
- Automation of engineering and deployment of robotic systems

Reference points of existing regulations / Initiatives / Other relevant elements

- The research findings of the recently established Robotics Institute Germany (RIG) can be leveraged for technology transfer.
- The VDMA Robotics + Automation Association is calling on the federal government to develop a strategy for humanoid robots in Germany.
- Additional initiatives from the Future Council include a flagship project on AI-based robotics in industrial applications (Project RoX) and a certification seal for AI-based robots.
- Attention should also be given to numerous initiatives and ecosystems in the federal states, such as Cyber Valley or Robotics Valley in Baden-Württemberg.

Costs / Compliance efforts

for politics and administration:
medium

for the industry:
medium

Timeline

medium term

Complexity level

high

Challenges in implementation / Critical success factors

The greatest challenge lies in developing intelligent robotics and automation solutions that can be deployed by companies quickly and cost-effectively. This requires a targeted effort to attract skilled professionals from engineering and IT fields. Furthermore, policymakers and businesses must work together to promote the acceptance of intelligent automation, such as humanoid robots.

Recommendations for concrete next steps

Three specific action blocks are proposed as concrete next steps. These should be supported by two cross-cutting initiatives, which will be explained following the three specific steps:

1. **Development of a robot foundation model "RobotGPT":** Application-oriented foundation models for manufacturing companies should be researched to enable cost-effective and low-effort development of highly flexible automation systems for intralogistics, production and assembly within the German supplier industry. Targeted funding programmes must support the development, testing and widespread adoption of foundation models for specific areas of automation to address both the skilled labour shortage and cost pressures in Germany.

   The focus of RobotGPT is on enhancing the dexterity of robots, an area where Germany can generate technological value. Robotic hands must be programmed or trained for their tasks, with approaches ranging from imitation learning to reinforcement learning in simulations. Pre-training on a wide variety of objects would facilitate more efficient programming and more robust execution, but such training models are currently lacking. An initiative to create a database of training objects and subsequently develop training models for industry use would therefore be highly beneficial.

2. **Centre for humanoid robotic technologies for industrial applications:** Humanoid robots offer new application possibilities in production and logistics through their human-like flexibility. Currently, the market is dominated by US and Chinese providers, as they possess extensive data. This poses the risk that large tech companies retain data sovereignty. In this context, the quality of data is more crucial than its quantity, as demonstrated by the example of ChatGPT. It is recommended to specifically focus on funding projects on the collection of high-quality, real-world robot data.

   This can be achieved by establishing real-world laboratories in production and logistics environments, where specific processes and work steps are documented. The goal is to develop and continuously improve a German base model for controlling humanoid robots. Additionally, collaborations between companies and research institutions should be promoted to make data usable across companies. Suitable frameworks for data rights must be created to achieve scale effects and strengthen Germany's competitiveness in the field of humanoid robotics.

3. **Low-threshold AI robotics funding for SMEs:** Low-threshold financial support programmes should be offered to SMEs, enabling them to maintain and expand their competitiveness through AI and robotics solutions. The continued success of the German automotive industry relies significantly on the contribution of SMEs. A highly successful example of such an initiative is the AI Progress Centre in Baden-Württemberg, which has implemented €10 million in projects with SMEs over the past five years through "Quick Checks," "Exploring Projects," and demonstrators. This approach specifically supports manufacturing companies in adopting AI robotics and driving transformation within Germany.

   Established transfer centres, such as the AI Progress Centre for Learning Systems and Cognitive Robotics, can serve as role models for this endeavour.

6.5 Action sheet 5 – Advancing automated and connected driving

IMPROVE THE FRAMEWORK CONDITIONS FOR AUTOMATED AND CONNECTED DRIVING

Challenges and goals

Automated and connected driving will make up a larger share of a vehicle's value creation in the future and become an important differentiating factor in the competition for customers. German manufacturers currently hold a leading position in the development of autonomous driving systems. In order to maintain this strong position in the commercial services sector for Level 4 driving, additional efforts are required.

Approach / Benefits

The solution approach includes coordinated activities in the areas of vehicle and infrastructure technology, legal framework, communication (promoting acceptance), as well as testing and operational areas (to enable scaling).

Reference points of existing regulations / Initiatives / Other relevant elements

Key reference points are the Implementing Regulation 2022/1426 regarding EU type approvals for motor vehicles with autonomous driving functions (Level 4), as well as the EU AI Act, which also includes sector-specific AI regulation for the automotive sector.

Costs / Compliance efforts

for politics and administration:
medium

for the industry:
high

Timeline

medium term

Complexity level

high

Challenges in implementation / Critical success factors

The described measures will be effective in combination with each other and must therefore be addressed simultaneously.

Recommendations for concrete next steps

Strengthening vehicle and infrastructure technology.

- Digital data on the static and dynamic conditions of the traffic space should be made available to all road users in a current and reliable manner. While providing such data is not strictly necessary for automated driving, it can enhance its safety and reliability.
- To efficiently and comparably ensure the functional safety of automated driving systems, scenario-based testing, scenario databases, reference frameworks for virtual tool chains and the homologation of software updates for safety-critical driving functions should be established across the board, involving the Federal Motor Transport Authority (Kraftfahrtbundesamt).

- To address the differing geopolitical conditions, it is recommended to expand collaborations at the European level between OEMs, suppliers, technical services, universities, research institutions, associations such as the VDA and authorities within the framework allowed by antitrust laws, leveraging synergies (*see ETA Short Paper "Bringing Automated and Connected Driving to the Road," 2024*).

- To establish Germany as a technology hub for highly automated driving, it is recommended to continue the targeted funding of pre-competitive, cross-manufacturer research, particularly in the areas of 1. Sensor technology, actuators, environment perception and prediction, 2. Data ecosystems, 3. Human-machine interfaces both inside and outside the vehicle and 4. Artificial intelligence. The IPCEI for ACD, as recommended in the Draghi Report, is supported.

- Europe-wide harmonised standards would make the development and implementation of ACD systems faster and more efficient. Relevant areas for standardisation could include interfaces, such as those between vehicles, infrastructure, or emergency vehicles. Additionally, vehicle communication with their environment (e.g., Automated Driving Marker Lights), certification requirements, as well as testing and validation processes, offer opportunities for standardisation.

Establishing reliable legal frameworks

- The existing European legal framework must be extended to cover mass production to enable scaling. Currently, the German Federal Motor Transport Authority (Kraftfahrtbundesamt) can only grant EU type approvals for vehicles with autonomous driving functions (Level 4) under the EU Implementing Regulation 2022/1426 for small series (up to 1,500 vehicles).

- The anticipated development of sector-specific AI regulations for the automotive sector under the EU AI Act will be highly relevant for the development and implementation of ACD functions. Early clarification of guidelines for sectoral automotive AI regulation would be desirable as a reliable foundation for designing AI-related vehicle applications.

Promoting public acceptance

- During the introduction phase of ACD technologies, it is essential to inform the public early and transparently to foster acceptance for the vision of new mobility. To achieve this, a joint approach involving industry, policymakers and operators should be developed for citizen engagement, as well as for communicating opportunities and risks.

- The overarching goal must be to ensure that approved automated systems are demonstrably safer than human-operated systems and that they meet relevant standards in a binding manner. In close collaboration, including with the European Commission, a unified understanding of safety should be developed to define binding, quantifiable metrics and target values for the safety of automated vehicles and systems.

- Automated driving should also be leveraged to further enhance energy efficiency in the transport sector.

Enabling scalable business models

- Stakeholders in Germany should focus on scalable use cases to ensure that development, testing and approval costs do not hinder economically viable business models and that implementation experience can be shared more quickly.

- A practical approval process for ACD operational areas, which builds on previous assessments of similar operational areas when examining new ones and does not require a comprehensive re-examination, would be helpful.

- Limiting the scope of application can significantly reduce the complexity of requirements for automated systems. This limitation also helps in better determining the economic viability of the application. Accordingly, accelerated technology scaling by companies in goods logistics in controlled operational areas or in passenger transport, such as public transport, is recommended through a temporary restriction to traffic-technically simple route areas, followed by gradual expansion.

- The accelerated implementation of dual-mode vehicles, which can operate autonomously within certain operational areas and manually outside of them, is also a good opportunity to gain experience in the field of automation.

6.6 Action sheet 6 – Strengthening battery cell research and manufacturing

SECURING THE LONG-TERM COMPETITIVENESS OF THE GERMAN AUTOMOTIVE INDUSTRY THROUGH RESEARCH FUNDING FOR BATTERY CELL DEVELOPMENT, AS WELL AS ACHIEVING INTERNATIONAL COMPETITIVENESS IN EUROPEAN BATTERY CELL MANUFACTURING THROUGH STANDARDISATION, SCALING AND COOPERATION

Challenges and goals

Battery cell manufacturing is a central element of future value creation and is crucial for both the transformation of mobility and the energy sector. To become competitive in current technologies and generate unique selling points in the next generation (e.g., solid-state batteries), research and development must be further promoted. The expert group views the cuts made in battery research at the beginning of 2024 very critically with regard to Germany's long-term competitiveness. To avoid strategic dependencies (e.g., on China) in this key technology and at the same time benefit from the value creation, the goal is also to build a European cluster for battery cell manufacturing.

Approach / Benefits

In terms of battery cell manufacturing, the European industry must first achieve cost parity with sufficient quality and then secure a technological lead through innovations. The former requires appropriate standardisation, scaling and cooperation, while the latter should be primarily driven by suitable research funding.

The state should address all key parts of the battery ecosystem through its funding policies, as the components of the system are complementary to each other. These key components include, among others, cell development, cell, module and pack production, the battery management system and other battery components such as thermal management and recycling.

The benefits, in addition to higher supply security, include participation in a rapidly growing market without limiting the differentiation potential of various manufacturers.

Reference points of existing regulations / Initiatives / Other relevant elements

Existing funding programmes, such as the BMBF's umbrella concept for battery research, can serve as a foundation for this initiative. A key focus should always be the networking of research and industry to quickly establish innovations in the market. At the same time, bureaucratic processes should be streamlined to maintain focus on the essential aspects of research projects.

Standardisation can be built upon the EU Battery Regulation. It is important to involve both battery cell manufacturers and equipment builders, as standardisation in a dynamic market can also act as a brake on innovation. Increased cooperation can be achieved, among other means, with the help of industry associations such as the VDA or VDMA.

Costs / Compliance efforts

for politics and administration:
medium (research) / high (manufacturing)

for industry:
low (research) / high (manufacturing)

Timeline

short term (research) / medium to long term (manufacturing)

Complexity level

low (research) / very high (manufacturing)

Challenges in implementation / Critical success factors

A central challenge is the targeted promotion of the critical elements for the future automotive economy. Due to the dynamic nature of the market, regular reassessment of the measures taken is necessary. Additionally, it may be necessary to provide funding for other central elements in the future. Furthermore, it is crucial to keep bureaucratic barriers as low as possible to ensure that funding quickly contributes to enhancing Germany's competitiveness.

The current market situation is characterised by subsidised overcapacities in China, leading to low global battery prices. As a result, achieving cost parity in battery cell production is even more challenging. The focus should be on navigating through the coming critical years, until scale and learning effects in Europe start to take effect.

Recommendations for concrete next steps

- To strengthen battery cell research, the budgets for funding programs should be increased, particularly for research formats that support the transfer into industry (e.g., research clusters and collaborative research with industrial involvement).
- Bureaucratic barriers to participation and project execution should be reduced. Additionally, targeted start-up support and the expansion of training and education are recommended.
- To achieve this, research funding needs to be restructured: A concerted research strategy for batteries, aimed at the development of new cell chemistries and material substitution (Technology Readiness Level/TRL 1-4), must plan for the entire development path through to production technology (TRL 8) from the start and also support the optimisation of this production technology during industrialisation. Particularly, German equipment suppliers must be empowered through targeted application research to enable competitive advantages through better production systems for existing technologies. These competitive advantages can be realised by significantly reducing scrap rates and substantially lowering the demand for materials and energy.
- To strengthen internationally competitive European battery cell manufacturing, it is necessary to promote cooperation among European equipment manufacturers, provide and/or secure capital for investments, support research funding in battery cell manufacturing, encourage broad education and training and promote start-up funding.
- Digitally connected battery cell production: New, end-to-end, flexible and state-of-the-art factory operating system solutions for battery cell production need to be designed and implemented. These will enable a quick and low-risk ramp-up as well as efficient operation of the manufacturing process. Special attention is required for comprehensive data collection, analysis and utilisation during the ramp-up and operational phases. A digital model of the physical factory allows for early testing and secure commissioning of the factory automation solution as well as the production equipment. Additionally, the use of AI technologies can significantly enhance efficiency and quality in battery production.

6.7 Action sheet 7 – Securing raw material supply for batteries and building a battery circular economy

Challenges and goals

The German automotive industry is highly dependent on imports of raw materials and semi-finished goods from non-European countries for electrification. Over 90% of processed raw materials come from Asia, particularly China. To reduce the general dependency associated with batteries and to utilise existing batteries as efficiently as possible, the establishment of a European battery recycling economy should be strongly promoted.

Approach / Benefits

The expert group recommends a broad and flexible package of measures for securing raw materials. A European battery recycling economy consists, among other things, of key elements such as the reuse and recycling of batteries. Reuse refers to the further utilisation of aged battery systems, while recycling involves the recovery of raw materials. This reduces the need for new materials, many of which are not available or produced in the EU. At the same time, the ecological footprint of batteries can be reduced.

Reference points of existing regulations / Initiatives / Other relevant elements

The EU regulations regarding raw material supply should be reviewed and harmonised: Regulations such as the Supply Chain Act, the EU Chemicals Regulation REACH, the EU regulations on ESG, the EU Critical Raw Materials Act and the revision of the EU End-of-Life Vehicle Directive should be examined for conflicts of objectives (e.g., between raw material supply security and other protective goals) and contradictions and, if necessary, unified.

In terms of a battery recycling economy, the EU Battery Regulation, which has already laid good foundations in parts, can be built upon. However, there is a need for further work, particularly in the standardisation of connectors and joining technologies, to reduce costs for disassembly and unloading. This will allow recycling to not only contribute to supply security in the medium term but also lead to cost reductions.

Costs / Compliance efforts

for politics and administration:
raw materials supply (high) / circular economy (medium)

für Wirtschaft:
raw materials supply (high) / circular economy (medium)

Timeline

medium to long term

Complexity level

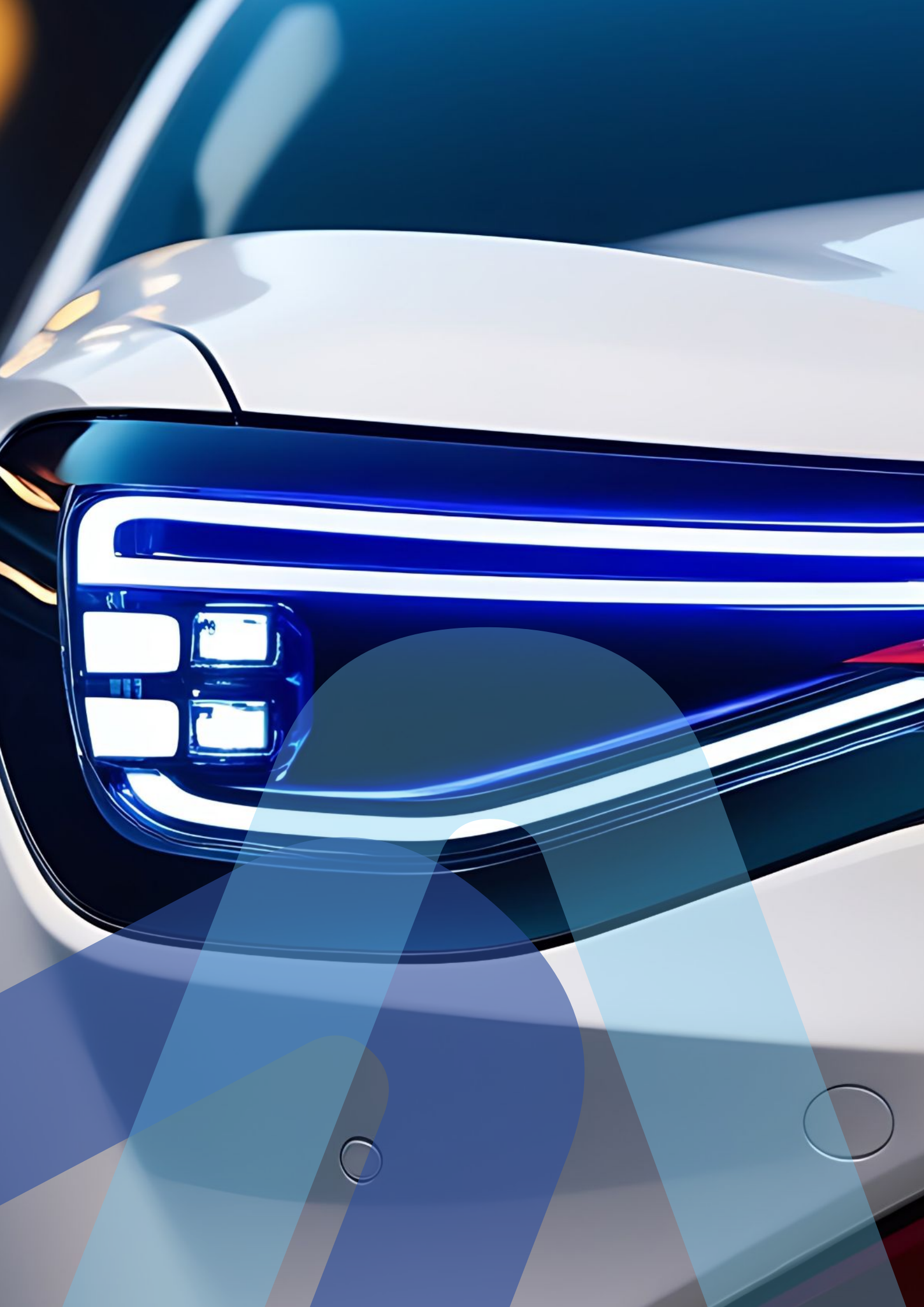
high

Challenges in implementation / Critical success factors

- To secure the supply of raw materials for batteries, high levels of coordination with the European level are necessary, as raw material supply is a pan-European issue.
- Ensuring raw material supply security through greater diversification reduces risks but comes with higher costs. Policymakers and society need to be made aware of this and acceptance for these measures must be fostered.
- Standardisation in a dynamic market remains a constant challenge, requiring a high level of communication among all market participants to address effectively. Furthermore, the current development of battery systems prioritises cost and performance over sustainability, as these factors are crucial to establishing electromobility as a viable propulsion option in the market.
- For the widespread adoption of electromobility and the energy transition in Germany and Europe, batteries in vast quantities are essential. Without highly efficient reuse, remanufacturing, repurposing, repair and recycling as key elements of a circular economy, such an endeavour would neither be ecologically sustainable nor feasible. Developing comprehensive circular concepts is therefore crucial to meeting the requirements of the EU Battery Regulation. This begins with efficient disassembly and pre-sorting and extends to demand-driven discharging and early decision-making on the appropriate circular route. Furthermore, innovations in processes and methods for the various circular routes (reuse, remanufacturing, repurposing, repair, recycling) are urgently needed and must be developed promptly to meet the ever-growing global demand for lithium-ion batteries. Simultaneously, technical innovations in machinery, plant engineering and system integration strengthen Germany as a production location and contribute to achieving energy, mobility and climate neutrality goals.

Recommendations for concrete next steps

- Creating Transparency and Harmonising Regulation: Adequate measures require up-to-date information on the supply, demand, prices and criticality of raw materials. This foundation should be established through expanded and streamlined monitoring at both the German level (e.g., via the German Mineral Resources Agency - DERA at the Federal Institute for Geosciences and Natural Resources, BGR) and the European level (e.g., via the European Critical Raw Materials Board).
- Securing and Diversifying Non-European Imports: The growing demand for critical raw materials will not be nearly met through recycling and domestic production in the short to medium term (by 2030). Actively shaping external relations through new investment and trade agreements, resource partnerships, guarantees and loans for raw material projects, as well as establishing a resource fund, will be essential to secure and diversify imports.
- Developing and Processing Domestic Raw Materials: Extracting European raw material deposits can reduce import dependency in the long term, increase value creation and support higher environmental and social standards. This requires foundational measures such as modernising mining laws, fostering innovation and promoting public acceptance.
- The effectiveness, environmental compatibility, competitiveness and acceptance of all recommendations should be enhanced by advancing technical innovations. (*see ETA paper on raw material supply* and *BMWK/EY/IW Cologne research report*)
- To develop a battery circular economy, the standardisation of battery access (IT), connections and joining technologies should be prioritised. Additional measures include promoting research in the field of battery circular economy, supporting energy efficiency measures in cell production and simplifying battery transportation (*cf. ETA paper on raw material innovations and BMWK/EY/IW Cologne research report*).
- Development of a high-voltage-compatible autonomous dismantling technology for the disassembly of operational high-voltage batteries under voltage in an industrial environment, as well as the development of corresponding safety technologies.
- Development of new gentle dismantling technologies for the removal of functional battery cells from bonded Cell-to-Pack systems for second-life applications and highly efficient recycling.
- Development of a traceability concept for battery data from "old" to "new" batteries, unless already covered by the battery passport.



INDICATOR TABLE[7]

Indicator		2019	2023 (changes compared to 2022)	HY1 2024 (Changes compared to HY1 2023)
General market and competitive position				
Passenger car sales (units/share)	worldwide of which German OEM in Germany of which German OEM	80.1 m 20.0 % 3.6 m 70.3 %	75.7 m (+10 %) 18.5 % (+0.6 %pts) 2.8 m (+7.3%) 68.5% (+1.4%pts)	36.8 m (+2.9 %) / 1.47 m (+5.4 %) 68.1 % (-1.3 %pts)
Passenger car production (units/share)	worldwide of which German OEM in Germany	78.2 m 20.5 % 4.7 m	79.5 m (+10 %) 17.7 % (-0.4 %pts) 4.1 m (+18 %)	/ / 2.1 m (-5.3 %)
Foreign trade (units)	Passenger car exports from Germany Passenger car imports to Germany	3.7 m 2.9 m	3.1 m (+17 %) 2.5 m (+7 %)	1,6 m (-3 %) 1,2 m (-3 %)
Financial key figures (German OEM)	Revenue	€ 436.156 bn	€ 564.237 bn (+11.5 %)	€ 269.454 bn (-4.7 %)
Supplier position (German suppliers)	Number in the Top 100 Revenue share of the Top 100	17 22%	17 34,6%	/
Innovation strength (German automotive industry)	R&D expenditures (GER) Patent applications (GER)	€ 28,253 m 12.836	€ 30,000 m 10.618 (+2,5%)	/
Employees (at the location in Germany)	In vehicle manufacturing In supplier industry	484,100 310,500	465,800 (+1 %) 273,500 (±0 %)	466,600 (±0 %) (270,500 -1 %)
Sales of BEVs (units/share)	worldwide of which German OEM in Germany of which German OEM	1.5 m 9.5 % 63,300 49.5 %	9.0 m (+30 %) 16.6 % 524,219 (+11 %) 55.2 %	4.5 m (+14 %) 14.8% 184,125 (-16 %) 59.3%
Production of BEVs (units/share)	worldwide of which German OEM in Germany of which German OEM	1.7 m 10.6 % 82,000 100 %	10.6 m (+30 %) 9.0 % 955,374 90 %	/ / 482,949 79 %
BEV stock *(as of January 1st or July 1st)	Units (Passenger cars) Share	83,200 0.2 %	1.0 m 2.1 %	1.5 m 3.1 %
Public charging points	Total Fast charging points Charging index (Number of publicly accessible charging points per 1,000 electric passenger cars in Germany).	19,906 2,849 132	90,783 (+42 %) 14,977 (+51 %) 48	142,793 (+31 %) 30,048 (+50 %) 58
OEM executive board positions with IT reference	Share	1 von 26	1 von 24	1 von 24

7 Own presentation and calculations based on data from the VDA and the KBA.

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ABOUT THE EXPERT GROUP

The Expert Group Transformation of the Automotive Industry (ETA) is an independent advisory body of the Federal Ministry of Economic Affairs and Climate Action (BMWK). The Expert Group develops target and recipient-based recommendations for action for politicians, business and society in general, which can be used to successfully shape long-term structural change in the industry. The overarching goal is to achieve climate neutrality, in addition to securing value creation, jobs and apprenticeships in Germany as an automotive location.

The ETA consists of 13 people from the scientific community, business and society who were appointed by Federal Minister Dr. Robert Habeck for the 20th legislative period. Other experts, in addition to relevant institutions and stakeholders, are involved in the work of the ETA via flexible and agile work formats. The members receive no remuneration or expense allowance for their involvement in the ETA. The group of Experts is supported by a process and scientific monitoring team commissioned by the BMWK. The ETA has a sister body, the Expert Advisory Council on Climate Action in Mobility (EKM) at the Federal Ministry for Digital and Transport (BMDV). Both bodies are integrated into the Federal Government's Transformation of the Automotive and Mobility Industry Strategy Platform (STAM).

The ETA is responsible for the content. It develops statements, position papers and reports partly in its working groups, then deliberates and decides on them in plenary session, and subsequently publishes them under its own responsibility.

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