Towards a Community Acceleration Survey for Europe's automotive industry

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Abstract

The European automotive industry is undergoing a major transformation in light of the twin transitions of decarbonisation and digitalisation. While Europe has long held a leading position in internal combustion engine vehicles, it now faces increasing competition in the emerging net-zero technological trajectory centred on battery electric vehicles. Although aggregate indicators continue to reflect strong innovation performance by EU-based firms, they often do not differentiate between the legacy and emerging trajectories. As the global transformation of the automotive industry enters the 'acceleration phase'—marked by battery electric vehicles reaching mass markets—effective policy making requires more timely and differentiated evidence on changes in innovation activities and production capacity. To address this need, this paper proposes the introduction of a Community Acceleration Survey (CAS) for the European automotive industry. Building on existing survey instruments, the CAS would enable a rapid tracking of developments in innovation activities and adjustments in production capacity across both legacy and emerging technology trajectories as well as corporate perceptions of clean industrial policy mixes. It would offer just-in-time policy insights by capturing firm-level data on the transformation of business activities and the role of policies. The paper outlines a proposed CAS questionnaire structure, consisting of five question blocks covering general enterprise information, clean industrial policy mix perceptions, innovation and production activities in both trajectories, organisational characteristics, and an assessment of and responses to acceleration challenges. The CAS is proposed for implementation in EU Member States with a strong automotive industry presence, such as Germany, France, Poland, the Czech Republic, and Italy. As a panel survey, it would generate a continuous and targeted evidence base to support European policymakers in navigating the ongoing transformation of the automotive industry in a manner that aligns decarbonisation efforts with industrial competitiveness.

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Executive summary

In light of ongoing twin transitions, Europe's automotive industry is under severe pressure to reinvent itself. Having long been in a global leadership position for its innovativeness in internal combustion engine vehicles, over the past decades, global competitors have not only caught up in the legacy technological trajectory; more importantly, they have overtaken the European automotive industry in the emerging net-zero trajectory related to battery electric vehicles. However, aggregate innovation figures continue to showcase top positions for EU-based automotive industry firms, as many traditional innovation indicators do not differentiate between innovation in the legacy and emerging technology trajectory. For example, according to the Industrial R&D Investment Scoreboard, Europe's automotive industry remains in a prime position with its R&D investments; however, it also shows that global competitors are catching up quickly – particularly those from China. Indeed, China currently leads the global innovation race for battery electric vehicles, and is also dominating global supply chains in this emerging net-zero technological trajectory. Future-proofing Europe's automotive industry therefore calls for a concentration of business activities in this new technological trajectory. Such efforts require changes that go well beyond incremental improvements and transcend traditional sectoral boundaries. What is needed are multi-system innovations that bridge previous silos, including through strengthening the links with the electricity sector (e.g. building up the new infrastructure for charging) and harnessing digital technologies (e.g. for automated and connected driving, or smart bidirectional charging). Such multi-system innovations play an essential role in enabling decarbonisation through these new links between electricity and transport and ICT sectors.

This paper focuses on the decarbonisation of Europe's automotive industry through the electrification of transport – while acknowledging that digitalisation is a crucial topic as well. Regarding decarbonisation, the paper starts from the observation that battery electric vehicles have emerged as the dominant design in the new net-zero technological trajectory. By applying research on technology transitions, the paper highlights that the transition to electric vehicles has entered a new phase: the technology is taking off and rapid system changes are on the horizon. This so-called 'acceleration phase' differs from the earlier 'emergence phase' and is characterised by a set of specific challenges unique to this new phase, where battery electric vehicles are about to enter mass markets. These acceleration challenges are connected to the necessary changes within the whole system and to increasing interactions across multiple systems through electrification and digitalisation. They also comprise challenges associated with the decline of the polluting legacy trajectory and resistance to such changes (e.g. connected to job losses or backlash against climate policy) as well as contestations around setting the new rules in the emerging net-zero trajectory (e.g. data regulation, regulation governing charging solutions). The challenges specific to the 'acceleration phase' also encompass uncertain demand by consumers and limited willingness to change social practises, but also justice concerns connected to the transition to the new net-zero trajectory (e.g. affordability of the new technology for low-income households). Also, as market shares in the new technological trajectory grow, so do challenges arising from international dynamics (e.g. rebuilding of global value chains, competition from foreign pioneers, increasing geopolitical risks). All of these challenges imply that transition governance becomes a much more complex and cross-cutting task. Overall, policymakers, industry and other actors are being confronted with a multitude of cross-cutting, real-world acceleration challenges that require innovative solutions.

Policy making in Europe has started to tackle many of these acceleration challenges, with a renewed focus on aligning decarbonisation with competitiveness objectives. Building on a comprehensive European climate policy mix that has developed over time and been sharpened by

the Green Deal, much policy attention today is directed to the needs of European industry – both in terms of the net-zero transition of incumbent industries and the growth of Europe's innovative clean tech industries. Policymakers are thus striving for clean industrial policy mixes that, on the one hand, build on existing policies, and, on the other, complement these with new policies or adjust existing ones to better serve today's objectives. As for the automotive industry, the political willingness to take a broad policy mix approach is exemplified by the "Industrial Action Plan for the European Automotive Industry" published by the European Commission in March 2025. This plan addresses the challenges associated with digitalisation and decarbonisation with a complementary array of policy initiatives. Regarding the challenges arising for the European automotive industry from the global innovation race towards battery electric vehicles, the plan aims to strike a balance between climate and industrial policies, recognising the intricate connections between the two in the transition to the novel net-zero trajectory. However, it sends a mixed message: while CO_2 emission standards for 2025 are somewhat weakened, and investment uncertainty is increased around the 100% zero emission sales target for 2035, the remaining policy announcements provide various support measures for the new net-zero trajectory of battery electric vehicles, such as much needed stimulation of European demand, regulations driving alternative infrastructure investments, and support for domestic battery manufacturing.

These policy efforts would benefit from a rapid and ongoing evaluation of their impacts on corporate innovation and investment, to promptly be able to respond to unforeseen effects and unexpected developments, thereby safeguarding Europe's striving towards maintaining or regaining the competitiveness of its automotive industry. While Europe's sophisticated monitoring system offers a valuable evidence base, it has not been designed to take into consideration changes in technology trajectories, nor does it allow for sophisticated policy mix analyses. In principle, patent data can distinguish between inventions in the legacy vs emerging net-zero trajectory (ICEV vs EV), but this data source suffers from a delay of several years, which precludes immediate insights on effects of novel policies. Also, measuring innovation is just one part of the equation – in the 'acceleration phase', shifting production to the novel trajectory is equally relevant. Therefore, not only innovation but also production investment data is required for a comprehensive evidence base. Such evidence should capture the modernisation of existing and/or build-up of new manufacturing facilities aligned with the new technology trajectory, but also the decline in the legacy trajectory. Therefore, to support policymakers in successfully navigating the transformation of Europe's automotive industry in light of the global innovation race to battery electric vehicles, existing monitoring systems should distinguish between innovation activities and production capacity changes in the legacy and emerging technology trajectories, rather than only providing aggregate figures. A timely evaluation of such differentiated innovation and production data, as well as of the effects of policy mix changes, can be achieved by drawing on company survey data. For this, existing surveys could be modified to better capture technology trajectory changes with their associated expansions in the emerging net-zero trajectory and decline in the polluting legacy trajectory. For example, policy question blocks, such as the one in the eco-innovation module of the Community Innovation Survey, could be modified to capture ongoing policy mix changes in a more nuanced manner.

However, such changes to standard survey instruments can take a long time – time that Europe may not have, given the rapid global innovation race and quickly changing geopolitical contexts. In addition, such changes in standard survey instruments tend to be of an incremental nature and are limited in making sector-specific adjustments for an in-depth analysis of ongoing changes in legacy and emerging technological trajectories. Therefore, what is proposed here is the introduction of a sector-specific acceleration survey that captures the ongoing dynamics in the European automotive industry: a Community Acceleration Survey (CAS) conducted during the 'acceleration phase' of the

transformation of Europe's automotive industry. Inspired by the already existing Community Innovation Survey (CIS) and drawing on the Investment Survey of the European Investment Bank and the European Manufacturing Survey, as well as other survey instruments, this new acceleration survey should capture business activities in – and the policy mix for – both old and new trajectories, to enable a rapid tracking on industry developments as well as policy effectiveness, thereby enabling just-in-time policy advice for the unfolding transformation. This paper offers suggestions for how such a CAS questionnaire can be designed. Initially, the Community Acceleration Survey for the Automotive Industry could be introduced for EU Member States with a strong automotive industry, such as Germany, France, Poland, the Czech Republic, Italy, Romania, Spain, Hungary and others. Ideally, this survey is set up as a panel study, so that it can continuously provide a rapid response evidence base to help European policymakers successfully navigate Europe's automotive industry towards competitiveness in a net-zero future.

To this end, the paper offers important pointers as to how such a questionnaire of the proposed Community Acceleration Survey for Europe's automotive industry could look. It starts by outlining a suggested survey structure that encompasses five question blocks: an introduction asking for general information about enterprises, followed by a dedicated question block on the clean industrial policy mix. In this regard, the paper provides illustrative questions on how the instrument mix as well as policy mix characteristics might be captured. This deep dive on corporate perceptions of the policy mix is followed by the main survey block capturing business activities in innovation and production related to the legacy and emerging trajectory. Again, to illustrate the nature of this differentiation, the paper presents example questions: on the one hand, for capturing changes in innovation expenditures in both trajectories and, on the other, for gaining insights on adjustments of the production capacity for ICEVs and EVs, differentiating between modernising, replacing and reducing such capacities. The proposed CAS questionnaire is also meant to include standard questions on the organisational characteristics of enterprises in the automotive industry, ranging from employees to turnover and also encompassing resources and skills. Finally, the questionnaire would close by asking respondents about their assessments of current acceleration challenges, and also offer them the opportunity to share their policy preferences for navigating the transformation of Europe's automotive industry.

Of course, the introduction of a Community Acceleration Survey would require dedicated European efforts. This paper has outlined the contours for the CAS questionnaire and suggested introducing it in EU Member States with a strong presence of the automotive industry. Such an additional monitoring effort would provide a much-needed, up-to-date evidence base that policymakers could harness to effectively navigate the transformation of the European automotive industry in light of competitiveness and decarbonisation challenges. More precisely, it would cover a gap in micro-level, sector-specific evidence on industry developments and policy effectiveness.

1 Introduction

Transitioning to an innovative net-zero economy represents a great opportunity but also a major challenge for Europe – with the European automotive industry being a case in point (do Prado et al., 2025). Its modernisation requires changes that go well beyond incremental innovation in the legacy technology trajectory of internal combustion engine vehicles (ICEVs). Rather, in light of the global innovation race in the new technological trajectory of electric vehicles (EVs), Europe's automotive industry is under severe pressures to reinvent itself. Having long been in a global leadership position for its innovativeness in internal combustion engines, over the past decades global competitors have not only caught up in the legacy technological trajectory; more strikingly, they have overtaken the European automotive industry in the emerging net-zero trajectory connected to electric vehicles.

Yet, the European automotive industry remains highly innovative, as evidenced by R&D expenditures that place EU-based OEMs among the global leaders (Confraria et al., 2024). However, traditional innovation indicators do not differentiate between innovation related to the legacy and emerging net-zero technology trajectory. For example, according to the Industrial R&D Investment Scoreboard, Europe's automotive industry continues to hold a leading position in R&D investment. However, the scoreboard also indicates that global competitors – particularly those from China – are rapidly catching up [1]. Indeed, China currently leads the global innovation race for battery electric vehicles, and is also dominating global supply chains in this new technological domain (IEA, 2025). Detailed monitoring of innovation and employment is also available on a regional level, forecasting changes arising from the move to net-zero technologies, such as battery electric vehicles (Hindriks et al., 2024).

This data presents a solid basis for informing policymakers of ongoing trends at an industry, regional and company level, but falls short on two accounts. *First*, it does not fully capture the breadth of the new transition challenges European automotive manufacturers and suppliers face in light of the new phase the transition to e-mobility has entered, with battery electric vehicles having emerged as the dominant design beginning to enter mass markets. *Second*, it offers limited evidence for assessing the role of policies in these transformative change processes – such as the interplay between climate and industrial policies, or between EU and foreign policies. As a consequence, timely evaluations of changes to the real-world policy mix are hindered by insufficient evidence to determine their impact in driving the transformation of Europe's automotive industry. For example, little quantitative evidence exists that could inform the debate about the role of EU phase-out policies – such as the heavily debated and recently relaxed CO_2 emission standards for new vehicles.

However, future-proofing Europe's automotive industry requires well-informed policy support to help the industry to stay competitive in the net-zero future. Such policies must drive trajectory-changing, multi-system innovations that bridge traditional sectoral silos, thereby harnessing electrification and digitalisation for enabling the decarbonisation of transport. They also need to provide clear guidance and investment security to support the reorientation of business activities towards the emerging net-zero trajectory. To address these shortcomings, this paper suggests the introduction of a Community Acceleration Survey to strengthen Europe's evidence base for effective

[1] https://iri.jrc.ec.europa.eu/scoreboard/2024-eu-industrial-rd-investment-scoreboard (accessed May 1, 2025).

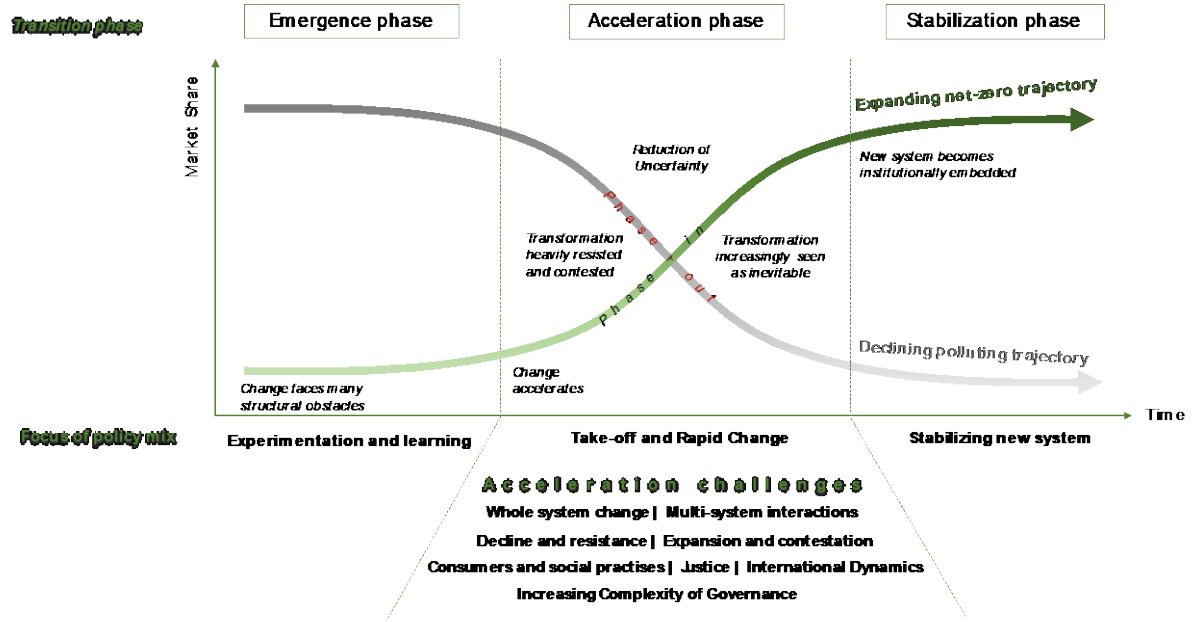
clean industrial policy mixes for successfully navigating the ongoing transformation of the automotive industry.

2 Acceleration phase of the transition to a zero-emission future

2.1 A new phase with novel challenges

Up until recently, the transition of the automotive industry towards e-mobility was still in its 'emergence phase', where policy interventions could focus on experimentation and learning, pursuing multiple alternatives for decarbonisation. While hybrid technologies continue to hold a strong position, battery electric vehicles are beginning to emerge as the dominant design in the new net-zero technological trajectory for passenger and light duty vehicles (Mirzadeh Phirouzabadi, 2025). They are also becoming increasingly attractive for the decarbonisation of heavy duty vehicles (Scherrer and Rogge, 2025). T he net-zero transition in the automotive industry in Europe has now entered a new phase in which electric vehicles are starting to take off and in which rapid system changes are on the horizon (see Figure 1). This so-called 'acceleration phase' (Markard, 2018) differs from the earlier 'emergence phase' and is characterised by the new net-zero technology is entering mass markets (Markard et al., 2020). For this 'acceleration phase', transition scholars have identified eight particular challenges that need to be tackled (for an overview, see Table 1). These challenges can be tackled by innovative solutions (e.g. new technologies, business models or social practises) and require well-coordinated responses from policymakers governing such transition processes (Rogge and Goedeking, 2024).

Figure 1: The 'acceleration phase' of net-zero transitions and its novel challenges



Source: Own illustration, drawing on Meadowcroft and Rosenbloom (2023) for the overview of transition phases, and on Rogge and Goedeking (2024) for the overview of challenges in the 'acceleration phase'

Table 1: Overview of challenges in the 'acceleration phase' of net-zero transitions

No	Challenge type	Description	Examples	Policy implications
1	Whole systems change	Major changes in system: complementary interactions between multiple innovations, fundamental changes in system architecture	Decentralization and intermittency of electricity supply (e.g., PV) requiring enabling technologies (e.g., storage, grids)	Focus on entire systems instead of singular innovations, support experimentation with socio-technical system change instead of sole focus on technological change
2	Multi-system interactions	Increasing changes in the interaction of multiple systems, with a focus on tensions in multi-system interactions	Electrification of transport, heating, industry; digitalisation of vehicles and grids; mining impact of shift to EVs	Overarching, cross-cutting missions; non-compartmentalized, more integral policymaking; multi-system task forces
3	Decline and resistance	Decline of existing industries and businesses, and multi-actor resistance to such decline	Petroleum industry, traditional combustion engine supply chain, and impacted shareholders, regions, unions, and politicians	Support structural change and reskilling of work force, create social acceptance, forge winning coalitions, compensate losers
4	Expansion and contestation	Contestation around the expanding trajectory, incl. framework conditions for new mass markets, securing future market shares and gains	Debates around ownership of charging stations and battery data, friction around manufacturers' focus on large EVs	Update electricity market designs, regulate data access, set product and green finance standards, incentivize faster portfolio shifts to clean tech
5	Consumers and social practices	Major changes in consumer practices and demand patterns	Home charging instead of refuelling at petrol stations, car sharing, shifting from car-only towards multi-modal transport	Stimulate technology adoption, behavioural change and learning-by-using processes; enable new business models; adjust planning
6	Justice	Multi-dimensional justice implications of system changes and affordability of new technologies for low-income households	Access to affordable charging for multi-unit housing, availability of affordable EVs (e.g., used car market)	Include a broad justice approach in policy design and evaluation, tailor policies to low-income households
7	International dynamics	Global interplay driven by international competition, pioneering countries, geopolitical risks, and changes in global value chains	IRA incentivizing US battery production, Chinese OEMs entering foreign EV markets, securing critical raw materials	Renewed focus on green industrial policy, strategic resource partnerships, free trade clubs among like-minded partners
8	Governance	Increasing complexity of governance, policy paradigm change towards greater policy intervention	Multi-level collaboration in charging infrastructure roll-out; new e-mobility tasks for electricity market and grid regulators	Stronger vertical and horizontal policy coordination, governance reform, designing policy mixes for creative destruction, policy sequencing

Source: Rogge and Goedeking (2024), building on Markard et al. (2020).

One of these additional acceleration challenges concerns the necessary system changes that go beyond merely introducing electric vehicles, as a successful transition also depends on complementary technologies and infrastructures (Andersen et al., 2023; Markard and Hoffmann, 2016). Another key challenge is managing the growing interactions across multiple systems, driven

by electrification and digitalisation (Andersen et al., 2020; Andersen and Geels, 2023). These challenges also include dealing with the decline of the polluting legacy trajectory and resistance to such changes – for example, concerns about job losses or backlash against climate policy (Koretsky et al., 2022; Meckling and Nahm, 2018). Moreover, increasing contestations over the new rules in the emerging net-zero trajectory – such as data regulation or the governance of charging solutions – are gaining importance, as these rules will influence the success of novel business models and determine future market shares (Roberts and Geels, 2019; Rogge and Goedeking, 2024). The 'acceleration phase' also entails uncertainty in consumer demand between legacy vs emerging technologies, along with a potentially limited willingness to change social practises, such as those related to refueling (Schot et al., 2016; Sopjani et al., 2019; Whittle et al., 2019). In parallel, justice concerns connected to the transition to the new net-zero trajectory are becoming mor prominent, such as the affordability of new technologies – like electric vehicles – for low-income households (Skjølsvold and Coenen, 2021; van Bommel and Höffken, 2023). Finally, as the market shares of products and services in the new trajectory increase, so do challenges linked to international dynamics, including both global competition and complementarities (Kern and Rogge, 2016; Quitzow, 2015). These encompass the need to rebuild global value chains, adapt to shifts in global knowledge networks, respond to rising competition from foreign pioneers, and navigate the intensifying geopolitical risks affecting imports and exports.

2.2 Policy implications

All of these acceleration challenges mean that transition governance becomes a much more complex task (Wittmann et al., 2021; Meadowcroft and Rosenbloom, 2023, Song et al. 2023), with policymakers, industry and other actors facing a multitude of cross-cutting, real-world acceleration challenges that require innovative solutions. These challenges, unique to the 'acceleration phase' of net-zero transitions, have substantial policy implications.

- **Whole systems change:** The required far-reaching changes in the architecture of the automotive industry specifically – and in a broader sense also of the e-mobility eco-system – necessitate a shift in the focus of policy interventions: moving away from singular innovations towards a comprehensive monitoring of developments in the entire e-mobility system. This entails mapping out concurrent changes needed across multiple innovations and system dimensions. As a result, greater emphasis should be placed on experimenting with socio-technical system change and the dismantling of barriers that hinder it (e.g. infrastructure bottlenecks). These efforts are crucial to designing transition policy mixes aimed at future-proofing the European automotive industry.
- **Multi-system interactions:** The increasing interactions and tensions among the energy and mobility systems highlight the need for overarching, cross-cutting missions that consider the complexity arising from multiple systems undergoing net-zero transitions. Instead of solely pursuing traditional, compartmentalised policymaking, there should be a shift towards more integrated approaches and procedures, including the formation of multi-system task forces to tackle the challenges arising from growing multi-system interactions. The European Commission has already taken important steps in this direction.

— **Decline and resistance:** Incumbent actors can assume varying roles in net-zero transitions (Hockerts and Wüstenhagen, 2010; van Mossel et al., 2018): they can try to slow down transitions, but can also adapt and diversify, thus contributing to the acceleration of net-zero changes (Lockwood et al., 2019; Smink et al., 2015; Steen and Weaver, 2017). The design of transition policy mixes will play a key role for the speed and direction of such reorientation, with phase-out policies – such as the CO_2 emission standards for new vehicles – being particularly important in this regard. Additional policies include support for structural change processes and workforce reskilling; initiatives aimed at fostering social acceptance; the building of coalitions that stand to benefit from accelerating net-zero transitions; and compensation mechanisms for those adversely affected and struggling to transform without targeted policy support.

— **Expansion and contestation:** As the new policy framework conditions of the emerging net-zero trajectory will shape the distribution of future gains among stakeholders, policymakers should anticipate intensive contestation, with incumbents and new entrants competing for market shares in the future mass markets for electric vehicles and charging services. These corporate interests might not necessarily align with societal ones. It is therefore essential to assess how policy and institutional changes influence future net-zero trajectories – whether through reforms to electricity market designs, data access regulation, product standardisation, infrastructure development, or the promotion of faster shifts in corporate portfolios towards zero-emission solutions.

— **Consumers and social practices:** Entering the 'acceleration phase' requires not only appealing to early adopters but also reaching mass markets, where consumers may be more hesitant to adopt electric vehicles if they involve significant shifts in behavioural practises (Markard et al., 2020). For policymaking, this suggests that the uptake of electric vehicles would benefit from supporting programs that foster behavioural change and learning-by-using (Gazheli et al., 2015; Huttunen et al., 2021). In addition, policies targeting practise changes should facilitate the development of new business models that favour shifts in consumer practises and demand reductions (Petzer et al., 2020; Ruggiero et al., 2021; Sarasini and Langeland, 2021). Policy mixes should also promote more holistic solutions, such as through changes to urban or regional planning – for example, by providing appealing charging options for residents of multi-unit housing.

— **Justice:** In the 'acceleration phase', the multi-dimensional implications of justice in net-zero transitions – including the affordability of zero-emission technologies such as electric vehicles for low-income households – are likely to gain greater political relevance. Failure to address these justice-related challenges may provoke backlash (Huber and Wicki, 2021), ultimately undermining progress towards modernising the European automotive industry in the context of the global innovation race. For policymaking, this requires embedding a broad justice approach into policy design, monitoring, and evaluation. It also calls for increased attention to policy instruments and mixes specifically tailored to low-income households – for example, by offering income-based purchase subsidies for electric vehicles (e.g. social leasing) or by recycling revenues from carbon pricing to ease the burden on lower-income groups (Muth, 2023).

— **International dynamics:** An important novel challenge in the 'acceleration phase' is the growing significance of global interdependencies in the automotive industry associated with its move towards electric vehicles. This includes the reshuffling of global value chains, the declining international market shares of European incumbents, and the entry of international competitors into domestic markets with their net-zero innovations (Binz et al., 2017) – most notably Chinese OEMs and their battery electric vehicles. For policymaking, this calls for renewed attention to clean industrial policy as a central component of the overarching policy mix, including the forging of strategic resource partnerships and the creation of free trade clubs among like-minded partner countries. Furthermore, international dynamics should be integrated with justice considerations, potentially requiring policy coordination to build sustainable and just global value chains – for example in the sourcing of critical minerals (Sovacool et al., 2020).

— **Governance:** In the 'acceleration phase', governing the net-zero transition becomes increasingly complex and contested, as it involves navigating multiple acceleration challenges simultaneously (Markard et al., 2020). While transition policy mixes are arguably more effective when they support both the creation of trajectory-changing innovation and their broader diffusion by phasing out support for legacy technologies and practises (Kivimaa and Kern, 2016), such policy mixes oriented towards creative destruction often face political resistance and require the careful balancing of competing interests, even within the expanding trajectory. For policymakers, this entails a growing need for political acceleration capacity as well as improved vertical and horizontal policy coordination. It also implies a greater need for overarching analytical capacities for mapping policy mixes that move beyond narrow policy silos and instead take system actors as a starting point (Ossenbrink et al., 2019). Addressing the increased complexity of net-zero transitions such as the shift to e-mobility also demands for governance and institutional reforms that enable the design and implementation of policy mixes geared towards harnessing the powers of creative destruction. While such changes inevitably involve navigating uncertainty inherent in transition processes, they become more likely when support is built through reinforcing policy feedbacks (Rosenbloom, Meadowcroft and Cashore, 2019; Sewerin, Béland and Cashore, 2020; Lockwood, 2022).

3 Policy changes and monitoring of their impacts

3.1 Clean industrial policy mix for the European automotive industry

Policy making in Europe has begun to address many of these acceleration challenges, with a focus on aligning decarbonisation efforts with regaining or maintaining international competitiveness. Building on a comprehensive European climate policy mix that has evolved over time and been reinforced by the Green Deal, strong policy attention is now directed towards the needs of European industry – both in terms of the net-zero transition of incumbent industries, and the growth of Europe's innovative clean tech industry. The task at hand, therefore, is to develop a clean industrial policy mix that, on the one hand, builds on existing policies, and, on the other hand, complements them with new policies or adapts current ones to better meet today's policy objectives of competitiveness and decarbonisation.

For the European automotive industry, this commitment to a broad policy mix approach is exemplified by the "Industrial Action Plan for the European Automotive Industry", published by the European Commission in March 2025, and incorporated into its Clean Industrial Deal. This plan addresses the challenges stemming from digitalisation and decarbonisation with a complementary array of policy initiatives. In relation to the challenges arising for the European automotive industry from the global shift toward the emerging net-zero technology trajectory of electric vehicles, the plan aims to strike a balance between climate and industrial policies, recognising their interdependence in this transition.

Nonetheless, these proposed policy changes send a mixed message. On the one hand, the CO_2 emission standards for 2025 are somewhat weakened, and investment uncertainty around the ICEV phase-out by 2035 is increased, thereby undermining corporate perceptions of policy credibility. This decline in planning certainty could hinder the urgently needed investments in the new net-zero trajectory. On the other hand, the remaining policy announcements introduce various support measures for the new net-zero trajectory of electric vehicles, such as efforts to stimulate European demand for electric cars and trucks, support for alternative infrastructure investments and incentives for domestic battery manufacturing. These moves may be seen as a sign of continued political commitment to transforming the automotive industry, potentially enhancing corporate perceptions of policy credibility. However, it remains unclear how decision makers within the automotive industry interpretate these mixed signals. Furthermore, current monitoring systems offer only limited real-time insights into the impacts of the proposed policy changes on business activities.

3.2 Monitoring implications

Europe's monitoring practices were established long before the emergence of net-zero transitions entering the 'acceleration phase' and the unique challenges this phase poses. Therefore, this paper argues that a pit stop is in order: Are we still monitoring everything necessary to provide solid evidence for policy making, particularly now that several net-zero transitions have entered the 'acceleration phase'? The novel acceleration challenges outlined above imply greater demands on those governing net-zero transitions and coordinating effective policy mixes relevant for maintaining or regaining Europe's innovation-driven competitiveness. They also suggest that focusing monitoring solely on innovation is insufficient to address the challenges Europe currently faces – just as investment figures that fail to distinguish between polluting legacy and emerging net-zero technological trajectories are inadequate at this phase.

Therefore, this paper proposes generating more detailed and timely evidence on the role of clean industrial policy mixes in supporting Europe's industry in general – and its automotive industry in particular. Such evidence is essential for successfully tackling the new challenges and for maintaining or regaining international competitiveness in the emerging net-zero trajectory of electric vehicles. More specifically, the current and planned policy mix changes would benefit from rapid, ongoing evaluations of their impacts on corporate innovation activities and changes in production capacity, enabling a prompt response to unforeseen effects and unexpected developments. In particular, for the automotive industry such enhanced firm-level monitoring and evaluation efforts could play a key role in providing much-needed additional evidence to support Europe in its quest to safeguard the international competitiveness of its automotive industry. These efforts would complement existing data based on sales, patents and other data sources that allow a differentiation of activities in legacy and emerging technological trajectories. That is, while Europe's sophisticated innovation monitoring system offers a highly valuable evidence base, it has not been designed to take into consideration changes in technological trajectories alongside a timely and differentiated assessment of real-world policy mixes.

Regarding the former, namely changes in technological trajectories, patent data can, in principle, distinguish between inventions in the legacy vs emerging net-zero trajectory – such as patens related to internal combustion engines vs electric drives – but this data source suffers from a delay of several years, which prevents real-time evidence on policy effects on innovation. Nonetheless, early evidence on the automotive industry demonstrates the value of such a distinction of patenting activities into different trajectories: it found that incumbent characteristics of existing OEMs (original equipment manufacturers) can hinder the impact of trajectory-changing demand pull policy mixes, but that accompanying these with technology push instruments and phase-out policies can improve policy effectiveness (Luetkehaus, 2025). However, measuring innovation is only one part of the equation – in the 'acceleration phase', shifting production to the novel trajectory is equally relevant to monitor. Therefore, the evidence base needs to encompass data on not only innovation activities but also on changes in production capacity. Such evidence should capture the modernisation of existing and/or the build-up of new manufacturing facilities aligned with the new technology trajectory of electric vehicles, as well as the corresponding reduction in production capacities in the legacy trajectory. Therefore, to support European policymakers in successfully navigating the transformation of the automotive industry amid the global innovation race towards battery electric vehicles, existing monitoring systems should distinguish between innovation activities and adjustments in production capacity in the old and new technology trajectory, rather than providing aggregate figures only.

Regarding the latter, namely a differentiated assessment of policy mixes, a timely evaluation of the effects of policy changes can be achieved by drawing on company survey data. However, the Community Innovation Survey – and, by extension, other corporate innovation surveys following the guidelines of the OECD's Oslo Manual [2] – fall short in adequately capturing the role of such real-world policy mixes relevant for net-zero transitions (Rogge and Schleich, 2018). Yet, modules capturing eco-innovation offer some initial inspiration on how to improve standard innovation monitoring instruments in this regard, as they sometimes include questions on policy determinants for eco-innovation (Horbach et al., 2012). While not fully incorporating insights on how policy mixes impact innovation activities (Rogge, 2019), these eco-innovation questions go well beyond the

[2] https://www.oecd.org/en/publications/oslo-manual-2018_9789264304604-en.html (accessed May 1, 2025).

outdated dichotomy of innovation policy as a driver, and laws and regulations as a barrier to innovation. In addition, the regular Investment Survey of the European Investment Bank (EIBIS), as well as its surveys specialised in clean tech sectors and start-ups, provide further insightful evidence on investment and innovation trends in European companies.[3] However, these surveys do not typically capture trajectory changes with their associated expansions in the new net-zero technological trajectory and decline in the polluting legacy technological trajectory; nor do they capture differentiated insights into policy mixes as determinants of such trajectory changes. For example, the EIBIS only captures the political and regulatory climate more generally, and lists this question under the topic 'investment impediments'.

Modifying existing surveys seems like a promising step to better capture policy mix changes and their impacts on shifting innovation and production capacity towards the new technology trajectory in real time. Such modifications can build on earlier research conducted for manufacturers of renewable energy generation technologies, which was based on the Community Innovation Survey and its informative eco-innovation questions, but introduced a dedicated block with policy mix questions (Rogge and Dütschke, 2018; Rogge and Schleich, 2018). Given that the transformation of the European automotive industry has entered the 'acceleration phase', such a policy mix block should include two main aspects. First, it should differentiate between policies supporting the phase-in of the newly emerging net-zero trajectory related to electric vehicles (green arrow in figure 1), and phase-out policies targeting the polluting legacy trajectory related to internal combustion engine vehicles (grey arrow in the same figure). That is, it should cover policy mixes for creative destruction, which have been argued to be crucial in the 'acceleration phase' of net-zero transitions (Kivimaa and Kern, 2016). Second, it should incorporate both climate policy and industrial policy, thereby considering evidence needs for clean industrial policy mixes. In addition, to measure trajectory changes – with their associated expansions in the new zero-emission trajectory and decline in the polluting legacy one – questions on innovation and production should be differentiated by the new and old technological trajectory – that is, those activities related to ICEVs and EVs.

[3] The EIBIS differentiates between the following investment areas: (1) organisations/ business process improvements, (2) training of employees, (3) software, data, IT networks and website activities, (4) research and development, (5) machinery and equipment, and (6) land, business buildings and infrastructure.

4 Towards a Community Acceleration Survey for Europe's automotive industry

Major changes to standard survey instruments tend to take a long time – time that Europe does not have, given the rapid global innovation race and quickly changing geopolitical contexts. In addition, these existing surveys cover the whole economy with all its sectors, making industry-specific questions and differentiations of technological trajectories difficult to implement. Therefore, this paper proposes the introduction of a sector-specific and time-bound acceleration survey that captures the ongoing dynamics in the European automotive industry during the 'acceleration phase' of the industry's transformation: a Community Acceleration Survey (CAS). This survey can draw upon the already existing Community Innovation Survey (CIS) [4], the Investment Survey of the European Investment Bank (EIBIS) [5], the European Manufacturing Survey (EMS) [6] as well as other continuous or one-off surveys on related topics. It should be directed at OEMs and suppliers in the European automotive industry, thereby encompassing all enterprises in the automotive value chain. The main aim of this new acceleration survey would be to capture the transformation of business activities and the perceptions of the clean industrial policy mix, thereby enabling a rapid tracking on industry developments as well as policy effectiveness.

This proposed Community Acceleration Survey for the Automotive Industry does not need to be conducted in all EU Member States, but could primarily focus on those Member States with a strong automotive industry, including Germany, France, Poland, the Czech Republic, Italy, Romania, Spain, Hungary, and others. Ideally, such a survey would be set up as a panel study repeated on a yearly basis for the next 5-15 years, enabling it to continuously provide a rapid-response evidence base for European policymakers interested in finding the best policy responses to help Europe's automotive industry safeguard its international competitiveness in the emerging net-zero trajectory related to electric vehicles. Of course, should other countries outside the EU be interested in joining this novel monitoring effort in the years to come, this would be welcome as it would widen the evidence base and allow for broader cross-country comparisons, for example with the UK, the US, Canada, Mexico, Japan, Korea, and China. However, it is proposed to initiate the acceleration survey within the EU to support its policy efforts by providing a regularly updated, industry-specific evidence base in this crucial phase of the transformation of Europe's automotive industry. If possible, the CAS survey can be set up so that it can be connected with other data already available at an aggregate level, e.g. within the EU Industrial R&D Investment Scoreboard, thereby potentially reducing the burden for respondents by avoiding the need to repeat previously provided aggregate figures.

In the following, this paper offers some initial suggestions for what the questionnaire for the Community Acceleration Survey could look like. These suggestions for the CAS questionnaire draw on research conducted within the ERC-funded EMPOCI project which investigates how to govern the cceleration of sustainable energy-mobility transitions. More specifically, the EMPOCI team is currently preparing the conduction of a pilot study for which it is in the process of developing, testing and refining such an acceleration survey, taking the example of Germany's automotive industry. Experiences gained in this pilot study could be incorporated into a future CAS initiative in

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4 https://ec.europa.eu/eurostat/web/microdata/community-innovation-survey (accessed May 1, 2025).

5 https://www.eib.org/en/surveys/index (accessed May 1, 2025).

6 https://www.isi.fraunhofer.de/en/themen/wertschoepfung/fems.html (accessed May 1, 2025).

Europe. This paper takes stock of some of the main developments of this ongoing research. It first presents a summary of the proposed survey structure (see section 4.1), then discusses how one could measure policy mix perceptions by enterprises in the automotive industry (see section 4.2), followed by insights into the measurement of the direction and speed of business activities (see section 4.3). It closes by shedding light into how the acceleration challenges introduced in section 2.1 could be explicitly covered in such a survey, rather than only explicitly informing questions in other blocks (see section 4.4). However, as in any survey, ultimately there is a trade-off between length of survey and response rate, and therefore some desirable questions may still not be asked every year, but rather only in selected survey rounds, depending on evidence needs. Other means to increase response rates include offering the choice of telephone (CATI) and online interviews (CAWI), as well as demonstrating the existence of political backing for the monitoring tool by policymakers at European and national levels.

4.1 Suggested survey structure

As shown in the overview in Box 1, five main question blocks are suggested for a Community Acceleration Survey. In Block I, the CAS would start with a typical introduction that identifies the headquarter, supply chain position and product portfolio [7,8] in the old and new technological trajectory[9] of each participating enterprise. This is followed by Block II, which would include questions about corporate perceptions of the clean industrial policy mix (see section 4.2). These questions are suggested to not only capture assessments on different types of policy instruments, but also of policy mix characteristics, to gather perceptions on the governance of the transformation of the automotive industry.

The main part of the CAS would be Block III, which would contain questions about the enterprise's business activities related to the old and new technological trajectory, with a focus on innovation activities and changes in production capacity (see section 4.3). Given the increasing importance of global links for the ongoing transformation of the European automotive industry, questions capturing the international dynamics of this transformation should also be included in this block. Finally, to allow for direct insights into the determinants of the enterprise's business activities, the CAS questionnaire is suggested to include questions on the market and policy determinants relevant to the ongoing transformation (or lack thereof).

As in any other innovation or investment surveys, in Block IV the CAS questionnaire would also include a fairly standardised set of questions on organisational characteristics of the enterprise, ranging from its number of employees to its turnover – broken down by the old and new technological trajectories – and its resources and skills available for the transformation. Finally, in the last block of the CAS, Block V, a question could ask about the perceptions of the most pressing current challenges faced by enterprises in the automotive industry during the 'acceleration phase'. Respondents could also be given the opportunity to share their preferences for future policy

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7 We suggest a differentiation between OEMs, suppliers (focusing on Tiers 1 and 2) and the wider automotive eco-system (such as charging equipment manufacturers).

8 We propose a distinction between goods and services related to passenger and light duty vehicles, heavy duty vehicles, and buses as main market segments.

9 The differentiation of technological trajectories – a term that, in the survey text, we would refer to as technological domains – is suggested to follow the classification provided by the European Alternative Fuels Observatory (https://alternative-fuels-observatory.ec.europa.eu/general-information/glossary, accessed on May 1, 2025).

changes, both in Member States and at the European level, and potentially also regarding responses to international policy developments, such as tariffs and other geopolitical risks.

Box 1. Suggested structure of the proposed community acceleration survey (cas)

I: INTRODUCTION: general information (e.g. HQ, supply chain position, technological domain)

II: POLICY MIX: policy framework conditions (e.g. policy instruments, policy mix characteristics)

III: BUSINESS ACTIVITIES: innovation, production, global links & determinants

III. A: Innovation activities (e.g. innovation types and changes over time per technological domain)

III. B: Changes in production capacity (e.g. modernisation, replacement, reduction per domain)

III. C: Global links (e.g. collaborators, supply chain dependence, export markets, foreign policies)

III. D: Determinants of business activities (e.g. market and policy factors as drivers and barriers)

IV: ORGANISATIONAL CHARACTERISTICS: employees, turnover, resources & skills

V: OUTLOOK: Current acceleration challenges & future policy changes

4.2 Clean Industrial Policy Mix

While typical innovation and investment surveys do not include a separate block of questions on the policy mix, the proposed CAS questionnaire differs in this regard.

Table 2: Overview of main components and optional deep dives in the policy mix block [1]

	Main components	**Optional deep dives**
Policy objectives	— Competitiveness — Decarbonisation — Energy Security — Circular Economy	— Key policy strategies with their long-term targets
Instrument mix (including policy instruments differentiating between ICEVs and EVs)	— Technology push — Demand pull — Systemic instruments — Industrial policy — Phase out policies — Environmental policies	— Core policy instruments with their design features and/or impact (e.g. CO_2 emission fleet standards)
Policy mix characteristics	— Consistency — Credibility — Comprehensiveness — Coherence	— Credibility changes over time
Governance	— Horizontal coordination — Vertical coordination	— Specific governing entities — Political institutions

[1] Only items for policy mix instruments require an explicit differentiation between ICEV and EV support.

Source: Author's own elaboration

Drawing on an innovation survey of manufacturers of renewable power generation technologies in Germany (Rogge and Dütschke, 2018; Rogge and Schleich, 2018), the second question block would provide enterprises with the opportunity to provider their perceptions of the clean industrial policy mix. Questions are suggested to be asked for the last complete calendar year, i.e. if the survey were

to be conducted in 2025, for example, then perceptions would be gathered for the year 2024. This allows respondents to clearly recall the policy mix of the recent past – a period that helps explain ongoing and future business activities. Table 2 provides an overview of the proposed main components of this question block, along with additional deep dives that could be included. In the following, for illustrative purposes, two components are unpacked in greater detail: the instrument mix and policy mix characteristics.

Box 2. Proposed Question on instrument mix [10]

For the year 2024, please say how much you think the instruments in the following policy areas have supported the transformation of the automotive industry in your country.

Please evaluate their support for the transformation from your enterprise's perspective using a scale from 1 to 6. 1 means "not supported at all" and 6 means "fully supported".

1. **Policy support for research, development and demonstration related to …**
— **…ICEVs** (e.g. for e-fuels)
— **… EVs** (e.g. for batteries)
2. **Policy support stimulating market demand for…**
— **… ICEVs** (e.g. preferential tax treatment)
— **… EVs** (e.g. purchasing subsidies)
3. **Policy support for the availability of….**
— **… cheap and clean electricity** (e.g. exemptions from surcharges)
— **… electric charging infrastructure** (e.g. funding programs)
— **… infrastructure for hydrogen** (e.g. funding programs
— **… open and secure data** (e.g. data regulation)
4. **Policy support for domestic production by…**
— **… providing finance for and de-risking of investments** (e.g. public loans)
— **… ensuring the availability of a skilled workforce** (e.g. retraining)
5. **Policies encouraging decarbonisation activities by…**
— **… producers** (e.g. CO_2 emissions fleet standards)
— **… consumers** (e.g. CO_2 price)
6. **Policies aimed at reducing environmental impacts from …**
— **… air pollution** (e.g. EURO 7 standards)
— **… resource use** (e.g. circular economy provisions)

Regarding the *instrument mix*, the Community Acceleration Survey has to strike a delicate balance between the differentiation of policy instruments, comparability across countries, the length of the survey, and the policy insights of respondents, including those of lower tier suppliers. At the same time, it should include items that capture policy support for the old and the new technological trajectory. It should also enable differentiated statements about climate and industrial policy, and it should capture core policy instruments at EU and Member State levels. Finally, instrument mix

[10] The following policy areas are captured: 1 = technology push, 2 = demand pull, 3 = systemic instruments, 4 = industrial policy, 5 = climate policies, and 6 = environmental policies. Explicit differentiation of old and new technological trajectories in 1 and 2, but implicitly also in 3. No explicit differentiation by EU and domestic policies, but implicitly acknowledging importance of EU-level policies in 5 and 6, but also in 3 and others.

questions recognise that enterprises may not explicitly differentiate between the origin of policies or between portfolios of similar policy instruments. As such, it is recommended that policy instruments are grouped by policy area, and that these are illustrated with key examples to support recognition by respondents. Box 2 illustrates what such a question could look like.

Regarding *policy mix characteristics*, the proposed Community Acceleration Survey should attempt to capture enterprises' perceptions of the nature of the clean industrial policy mix. At a minimum it should capture consistency and credibility of the mix; however, it is recommended to also include items assessing its comprehensiveness and coherence. This recommendation is based on the aforementioned survey research, which highlights that such policy mix characteristics – as perceived by enterprises – may explain business activities more effectively than evaluations of individual policy instruments. Box 3 provides an example question of how enterprises could be asked about their perception of consistency and comprehensiveness. Questions regarding policy mix coherence and credibility are suggested to be asked separately. The former could include a deep dive into horizontal and vertical policy coordination, while the latter could capture changes in the perceived strength of the political will to support the transformation of the European automotive industry.

Box 3: Proposed question on Policy Mix Characteristics: Consistency and comprehensiveness [11]

Considering all current policies and measures in your country, to which extent do you agree with the following statements?

Please evaluate the statements from your enterprise's perspective using a scale from 1 to 6. 1 means "do not agree at all" and 6 means "fully agree".

The transformation of the automotive industry in my country…

— … will be achieved with the existing policies.
— … is impeded by tensions between existing policies.
— … requires the introduction of important flanking policies.

4.3 Business activities: innovation and production

The main block of the proposed CAS questionnaire addresses business activities. In light of the challenge of maintaining or regaining the competitiveness of the European automotive industry in a net-zero future, the question block on business activities would zoom in on two areas of key importance: innovation and production. Therefore, a basic structure is suggested that follows the same logic for innovation activities as it does for changes in production capacity (see Table 3). Importantly, the questionnaire differentiates between activities and changes related to the old and new technological trajectories. That is, enterprises that have undertaken innovation activities or adjustments in their production capacity in the past three years will receive follow-up questions asking them to provide separate information for activities related to ICEVs and EVs. This includes the type of activities, the expenditures in the last year, changes in expenditures, and the receipt of

[11] The items capture instrument mix and policy mix consistency and comprehensiveness.

public support for these activities.[12] In the following, for illustrative purposes, two components are examined in greater detail: changes in innovation activities, and changes in production capacity.

Table 3: Overview of main questions in business activity block [1]

	Innovation activities		**Changes in production capacity**	
	ICEV	**EV**	**ICEV**	**EV**
Type	List of innovation types (Yes/No) (e.g. product, process or business model innovation)		List of possible changes (Yes/No) (e.g. modernisation, expansion, reduction)	
Expenditure	In Euro for last year			
Change	Comparison to past and present: Increase, stay about the same, decrease			
Public support	Received (Yes/No)			

[1] All items include an explicit differentiation between activities related to the ICEV and EV technological trajectories.

Source: Author's own elaboration

Box 4: Proposed question on Direction and Speed of Innovation related to ICEVs and/or EVs [13]

How do your enterprise's automotive innovation expenditure in 2024 compare to 2023? And how do you expect it to change in 2025?

Please answer for all relevant technological domains.

Changes in automotive innovation expenditures related to a) ICEVs and b) EVs

PAST: 2024 compared to 2023 {Choose one}:	*TODAY: 2025 compared to 2024 {Choose one}:*
— Increase → If yes, by approximately __ %	— Increase → If yes, by approximately __ %
— Stay about the same (+/- 5%)	— Stay about the same (+/- 5%)
— Decrease → If yes, by approximately __ %	— Decrease → If yes, by approximately __ %
— No innovation expenditure	— No innovation expenditure

Regarding the *changes in innovation activities*, the CAS questionnaire should first determine whether an enterprise has undertaken any innovation activities in its automotive business over the past three years. If so, respondents would be asked to identify which technological trajectories– ICEVs and/or EVs – these innovation activities were related to, and what type of innovations were introduced in each. Innovators would then be asked to report their innovation expenditures for the last year across all technological domains in which they have been active. That is, for a survey conducted in 2025, they would be asked to estimate the percentage split between ICEV and EV

[12] Suppliers whose products and services do not differ between the two technological trajectories should be recorded as trajectory-neutral, but they are still likely to be affected by broader market changes, such as shifts in sales volume, market shares, or the origin of their customers.

[13] To keep the box concise, the two technological trajectories are presented in parallel, but would be asked sequentially: first, changes in innovation expenditures related to ICEVs, followed by those related to EVs. Expenditures associated with changes in production capacity are suggested to be asked about in the same manner.

innovation expenditures for the preceding calendar year, 2024.[14] This captures the direction of innovation, but not its speed. The assessment of speed – i.e. the rate of change – is addressed by asking about how these expenditures compare to those of the previous year (i.e. the past) and to plans for the current year (i.e. the present). As shown in Box 4, the possible response categories are aligned with the Community Innovation Survey, capturing whether there was an increase, a decrease, or no change in innovation expenditures. Importantly, the CAS questionnaire differentiates these responses between the legacy and emerging technological trajectories. This assessment should be mirrored in a similar manner for expenditures related to changes in production capacity. Together, these figures would enable the calculation of an acceleration index.

Regarding the *changes in production capacity*, there are three main features that distinguish the CAS questionnaire from other surveys capturing production capacity adjustments. First, the CAS questionnaire is designed to differentiate between changes in the old and in the new technological trajectory. Second, it takes into account that the production capacity of the legacy trajectory is likely to eventually decline, and therefore offers a corresponding response option. Third, it reflects the ongoing changes in global supply chains by explicitly asking about relocations, drawing on insights from the European Manufacturing Survey (EMS). Given the uncertain and complex nature of transition processes, it is proposed that these questions be mirrored for both technological trajectories, in order to capture both acceleration and deceleration. Box 5 shows what such a question could look like. It would be followed by a similar set of questions as already outlined for the innovation section – namely, expenditures in 2024 by technological trajectory, and how these compare to the past (2023) and the present (2025).

Box 5: Proposed question on types of production capacity adjustments related to icevs / evs [15]

During the past three years 2022 to 2024, what type of production capacity adjustments did your enterprise undertake related to the following technological domains?

Select all that apply.

Production capacity adjustments related to a) ICEVs and b) EVs

1. **Modernizing production capacity** (e.g. upgrading or renewing existing ICEV/EV-related buildings, machinery, equipment or IT)
2. **Expanding production capacity** → If selected, ask to specify:

— Were some of these expansions connected to…

… adding new facilities for ICEVs / EVs?

…relocating ICEV/EV-related facilities into your home market? (If yes, specify origin country: _____)

3. **Reducing production capacity** (e.g. repurposing or closing ICEV-related facilities) → If selected, ask to specify:

— Were some of these reductions connected to…

… *repurposing facilities?* (e.g. shifting assets and equipment away from ICEV/EV-related production) (If yes, specify new purpose(s): _____)

… *relocating ICEV/EV-related facilities out of home market*? (If yes, specify destination country: ___)

[14] Again, enterprises whose innovation activities do not differ between the two technological trajectories should be recorded as trajectory-neutral.

[15] To keep the box concise, the two technological trajectories are presented in parallel, but would be asked sequentially: first, production capacity adjustments related to ICEVs, followed by those related to EVs.

Finally, as indicated in Table 3, both the innovation and production sections of the CAS questionnaire would conclude with a question on any public funding received to support ICEV- or EV-related innovation activities or production capacity changes. Further questions on the market and policy determinants of enterprises' business activities – focusing on their reorientation from the legacy to the emerging technological trajectory[16] – are suggested for inclusion in the final section of Block III of the CAS survey.

4.4 Acceleration challenges

The assessment and response to current acceleration challenges could be one question in the final block of the Community Acceleration Survey. While not all real-world challenges can be included, survey designers can determine key challenges at any given year the survey is run, to better grasp the perceptions of enterprises in Europe's automotive industry as well as how these challenges are influencing their business activities. Such a question could, for example, include corporate perceptions on current challenges associated with:

- **Whole system change:** … limited availability of charging infrastructure; slow electricity grid upgrades and expansions
- **Multi-system interactions:** high electricity and/or energy prices; obstacles to automated and connected driving
- **Decline and resistance:** loss of jobs in the automotive industry; shrinking profits of European car manufacturers; rising backlash to ambitious climate action
- **Expansion and contestation:** slow mass market uptake of EVs; shortage of skilled labour; lack of a common vision for the future of mobility
- **Consumers & social practises:** limited public acceptance for EVs; emotional attachment to ICEVs
- **Justice:** limited availability of affordable EVs; lack of affordable charging solutions in multi-unit housing
- **International dynamics:** strong competition from Chinese manufacturers; high geopolitical tensions and trade risks from tariffs
- **Governance**: unpredictable future policy support for EVs; continuation of tax benefits for ICEVs.

Other challenges could be added to this list, such as challenges unique to individual Member States. Of course, the list of challenges is not fixed but should rather be understood as dynamic, as over time some challenges will have been resolved while new challenges might have appeared. The development of relevant items could be done in a co-creative process involving relevant policy, business, research and civil society actors with expertise in Europe's automotive industry. Here, it is based on a study conducted by Rogge and Goedeking (2024) that draws on expert interviews and identified over 50 real-world acceleration challenges, which have been condensed to a list that is short enough for a survey of enterprises.

[16] Reorientation can comprise a range of activities; the CAS questionnaire could, for example, not only differentiate between innovation activities and production changes, but could further ask respondents about intellectual property rights, product portfolio, marketing strategy, digitalisation, organisational structure, human resource management, supply chain, mergers, acquisitions and joint ventures, public relations or political engagement.

5 Conclusions and outlook

This paper has outlined the contours for a Community Acceleration Survey (CAS) proposed for introduction in EU Member States with a strong automotive industry presence. It has been argued that such an additional monitoring effort would provide a much-needed, up-to-date, complementary evidence base that policymakers can harness to effectively navigate the transformation of the European automotive industry in light of competitiveness and decarbonisation objectives. More precisely, it would address a gap in micro-level, sector-specific evidence on transformative business activities and policy effectiveness in the acceleration phase of ongoing net-zero transitions.

However, this paper has not covered all the details of such a novel survey instrument. For example, given the global nature of the industry and the ongoing innovation race, dedicated attention should be given to international dynamics in technology, markets, and policy. While this paper has focused on providing evidence to policymakers striving for European competitiveness in a net-zero future, it has not explored the challenges and opportunities related to digitalisation, such as those linked to automated and connected driving. Nonetheless, the proposed CAS questionnaire could be readily extended to capture this dimension in greater detail.

Ultimately, the societal challenges of our times – from climate change and rising inequality to geopolitical tensions – demand not only the successful transformation of Europe's automotive industry, but also a broader rethinking of our interconnected energy-mobility systems. To capture these wider net-zero transitions, the Community Acceleration Surveys could be designed for a broader range of sectors and actors. For now, however, the European automotive industry provides a suitable starting point to gain initial experience and build a foundation for potential future expansions.

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