TRiREME

DIGITAL & GREEN SKILLS TOWARDS FUTURE OF THE MOBILITY ECOSYSTEM

Skills for the Mobility Transition: An Industry Perspective

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EXECUTIVE SUMMARY

This report presents findings from structured interviews with industrial stakeholders across the European automotive ecosystem conducted under the TRIREME Project within the year 2025. It assesses how the ongoing mobility transition is reshaping skills requirements, workforce structures, and the capacity of education and training systems to respond to emerging industrial needs.

Respondents emphasise that the sector's transformation is unfolding under significant pressure. Intensified global competition, geopolitical uncertainty, and supply-chain vulnerabilities are reshaping industrial strategies and accelerating the regionalisation of production and technology development. At the same time, the transition toward electrified and software-defined vehicles is increasing product complexity and development costs, requiring new capabilities across the value chain while compressing innovation cycles.

These structural shifts are reshaping workforce demand across the ecosystem. The most acute shortages relate to software engineering, AI and data capabilities, embedded systems, cybersecurity, electrification technologies, battery management, power electronics and digital manufacturing. At the same time, parts of the workforce linked to combustion-engine technologies face declining demand. The dominant challenge is therefore a skills mismatch: available labour capacity does not align with the pace and direction of technological change, limiting the ability of firms to redeploy workers internally and slowing industrial transformation.

Training and workforce transformation are constrained primarily by operational realities rather than awareness of the problem. Companies report limited capacity to release employees for training, insufficient availability of specialised external programmes, and difficulties scaling reskilling initiatives under tight production schedules. As a result, firms increasingly rely on internal solutions, targeted recruitment of scarce experts, and partnerships with universities and vocational providers. However, the speed of technological change continues to outpace the responsiveness of many education and training programmes.

Overall, the findings highlight that the mobility transition is as much a workforce transformation challenge as a technological one. Closing the emerging capability gap will require faster alignment between industry needs and education systems, scalable reskilling pathways for the existing workforce, and stronger coordination across industrial, education and policy stakeholders to ensure that the required capabilities can be developed and deployed at the necessary speed and scale.

INTRODUCTION

This report is part of the Deliverable D2.3 of the Task 2.2 Periodic Continuous Survey and Interviews of the TRIREME Project. The TRIREME Project aims to address the re-skilling, up-skilling, training, and skills strategy for a substantial demographic - over 14.6 million individuals employed within the Mobility-Transport-Automotive Ecosystem.

In this iteration, the Task 2.2 conducted structured interviews. The interviews were carried out by consortium partners in two phases: Phase I in June and July 2025, and Phase II from mid-September to mid-November 2025. The target group consisted chiefly of industrial stakeholders, with most respondents drawn from mid- to high-level management and human resources positions. This profile was selected to ensure that the information gathered reflects both strategic decision-making processes and the operational execution and needs related to workforce planning, skills requirements, and organisational change.

All interviews followed a common structure, comprised of six thematic areas, within which 37 individual topics were addressed. The thematic areas are:

- Shaping the Future of the Automotive-Mobility Sector
- Skills and Roles for a Changing Industry
- Future Workforce Needs – How Many and What Kind?
- Managing Job Losses and Workforce Transition
- Closing the Gap – Is Education and Training Keeping Up?
- Delivering the Right Skills at the Right Time

The first thematic area, "Shaping the Future of the Automotive-Mobility Sector," explored the main global, technological, and market trends shaping the automotive-mobility ecosystem, including developments related to electrification, digitalisation, automation, and evolving mobility models, as well as their implications for industry competitiveness and supply chains.

The second area, "Skills and Roles for a Changing Industry," examined how technological transformation is reshaping workforce skills and occupational roles, including current skill gaps, barriers to upskilling and reskilling, emerging competencies expected to become important, and company approaches to workforce development and talent management.

The third thematic area, "Future Workforce Needs – How Many and What Kind?", addressed expected labour-market developments in the automotive-mobility sector, including labour shortages or overcapacity, shifts in workforce composition, and the balance between developing local talent and accessing global expertise.

The fourth thematic area, "Managing Job Losses and Workforce Transition," focused on how companies manage workforce restructuring linked to technological and market transitions, including barriers to workforce redeployment and retraining, as well as organisational, regulatory, and financial factors influencing workforce transition.

The fifth thematic area, "Closing the Gap – Is Education and Training Keeping Up?", considered the alignment between evolving industry skill needs and the capacity of education and training systems to respond, including the effectiveness of existing vocational and higher education pathways and the level of cooperation between industry and training providers.

The sixth thematic area, "Delivering the Right Skills at the Right Time," examined mechanisms that can support timely and effective skills development, including the roles of companies, education providers, and public institutions in coordinating training provision and responding to rapidly changing workforce needs.

Structure of respondents

A total of 60 respondents participated in the survey, providing a diverse and representative sample across the automotive ecosystem. Respondents span multiple positions in the supply and value chains, cover a wide range of organisational sizes, and are geographically distributed across several European countries. This breadth of participation ensures that the survey findings reflect perspectives from different industrial roles, functional activities and national contexts within the sector.[1]

Value chain position

The respondents cover a wide range of activities across the automotive value chain. Manufacturing and assembly represent the largest share, accounting for 66.7% of

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[1] Respondents could select more than one answer option; therefore, the percentages of graphs do not sum to 100%.

respondents, reflecting strong participation from organisations directly involved in production. R&D and design activities are also prominently represented at 48.3%, underlining the importance of innovation and engineering functions. Procurement and supply activities account for 25.0% of respondents, while after-sales and services represent 21.7%. Distribution and sales activities are covered by 13.3% of respondents, and end-of-life and recycling activities by 3.3%. In addition, other value-chain activities account for 25.0% of respondents, indicating further diversity beyond the core functional areas.
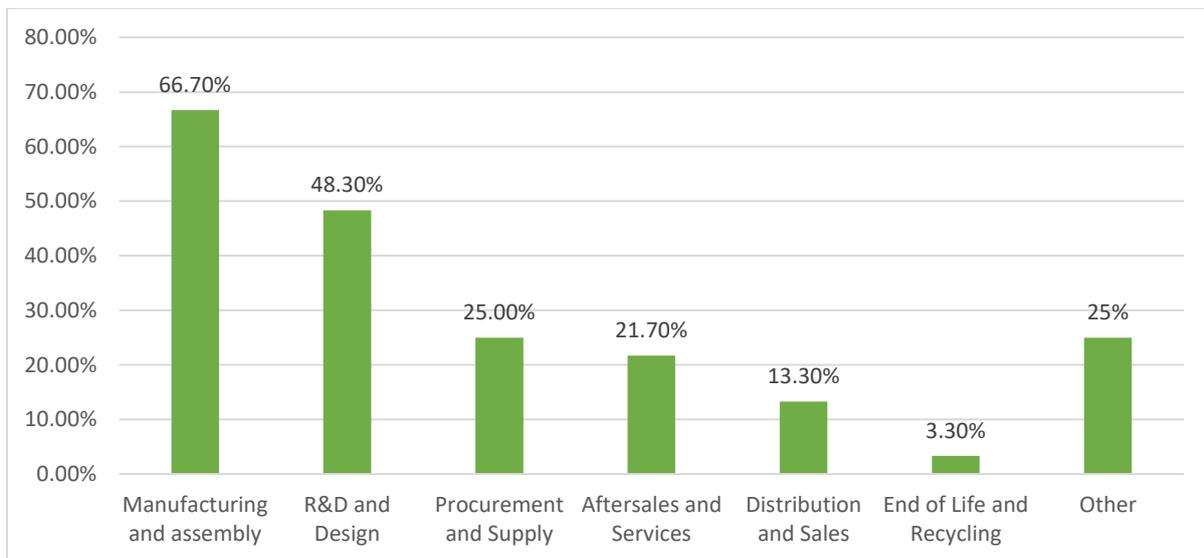

Figure 1 Respondents by value chain position

Supply chain position

The respondents reflect a broad coverage of the automotive supply chain. Tier 1 suppliers constitute the largest share of participants at 43.3%, indicating strong representation from companies directly supplying OEMs. OEMs themselves account for 21.7% of respondents, highlighting significant engagement from vehicle manufacturers. Further down the supply chain, Tier 2 suppliers represent 6.7% of participants, while Tier 0.5 suppliers account for 3.3%. In addition, other organisations make up 30.0% of respondents, capturing contributions from actors outside the traditional supplier tiers.[2]

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[2] Original equipment manufacturers (OEMs) design, assemble, and market vehicles. Tier 0.5 suppliers provide highly integrated subsystems or technologies directly to OEMs while often collaborating closely with Tier 1 suppliers. Tier 1 suppliers deliver complete systems or modules directly to OEMs. Tier 2 suppliers supply components, materials, or sub-assemblies to Tier 1 suppliers rather than directly to OEMs.
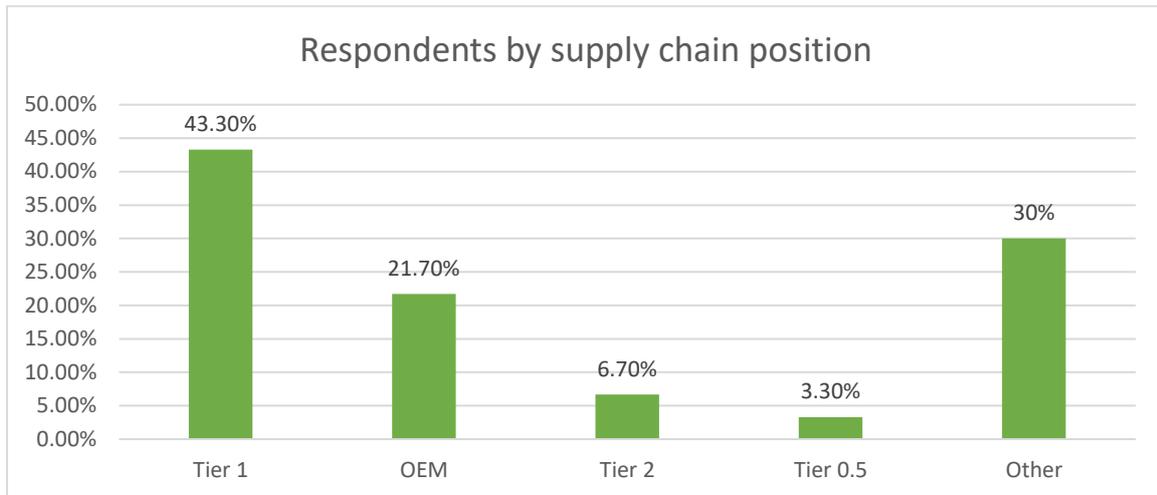
Respondents by supply chain position

Figure 2 Respondents by supply chain position

Size of organisation

The respondents are predominantly large organisations, with 72.9% employing 250 or more staff, indicating strong participation from established companies with significant operational scale. Small enterprises, defined as organisations with 10–49 employees, account for 15.3% of respondents, while micro enterprises with fewer than 10 employees represent 6.8%. Medium-sized organisations, employing between 50 and 249 staff, make up a smaller share at 5.1%, suggesting more limited representation from this segment compared to larger firms.
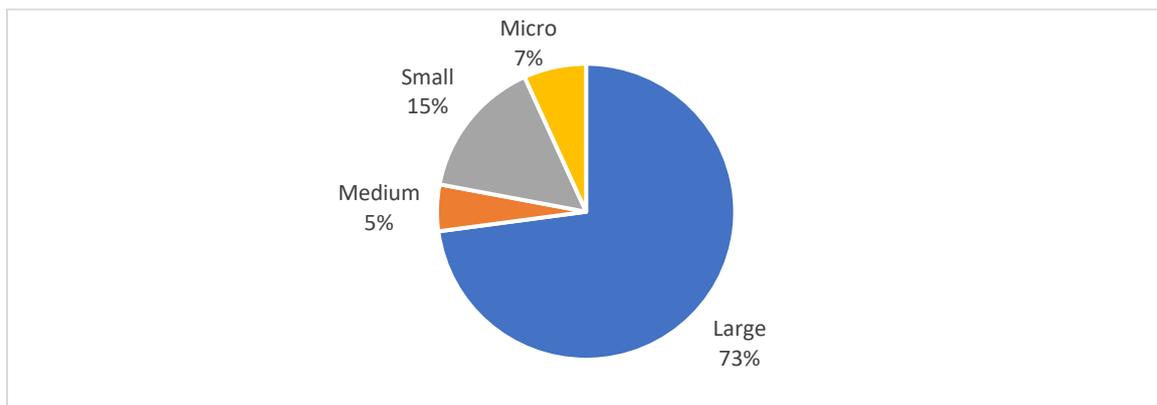

Figure 3 Respondents by size of organisation

Country of operation

Respondents are geographically diverse, with the largest share based in Spain at 20.0%, followed by Romania at 13.3%. Germany and Italy each account for 11.7% of respondents, while France and Portugal each represent 8.3%. Sweden contributes 6.7% of participants, and

Belgium accounts for 5.0%. Austria, Czechia, Denmark and Slovenia are each represented by 3.3% of respondents, indicating a broad spread of participation across multiple European countries.
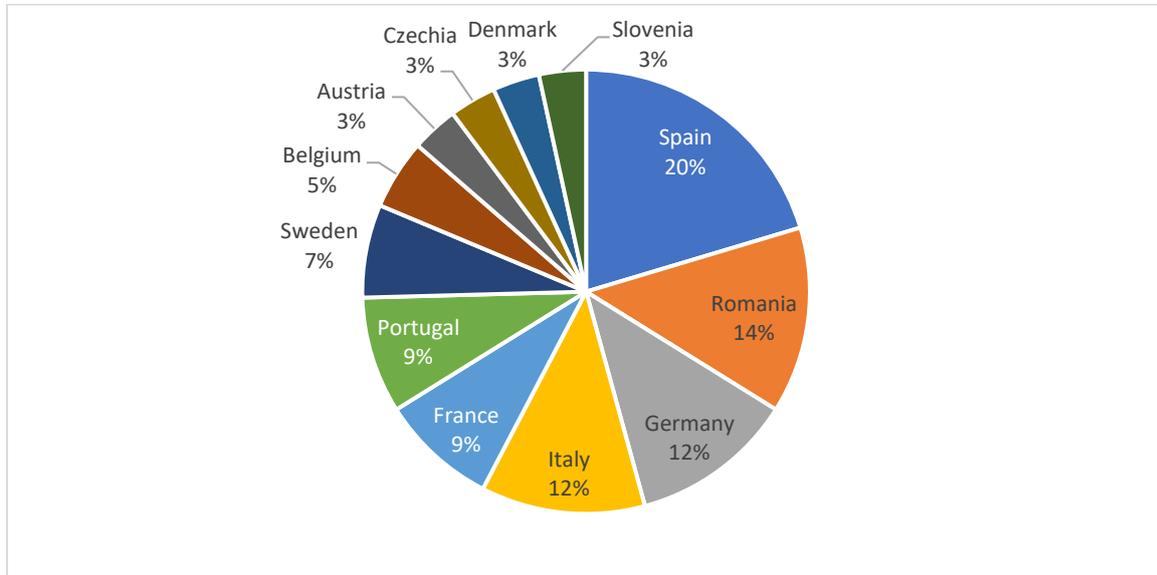

Figure 4 Respondents by country

1. SHAPING THE FUTURE OF THE AUTOMOTIVE-MOBILITY SECTOR

Three tightly linked forces—**decarbonisation, digitalisation, and automation**—are reshaping automotive mobility as a system rather than a set of isolated technology shifts. Decarbonisation is dominated by the move away from internal combustion toward electrification, with hydrogen repeatedly treated as a parallel path but one that remains constrained by maturity and infrastructure. Sustainability is framed as a full value-chain requirement: energy use, material choices, manufacturing footprints, and circularity ("cradle to grave") are becoming design and sourcing constraints, not optional branding. Readiness, however, is uneven: incentives and adoption differ sharply by country and region, while charging deployment, grid capacity and charging-price structures are frequently described as lagging the implied pace of vehicle transition. The scale mismatch between targets and current penetration is used to illustrate the challenge: one input notes roughly 13% electrified production (BEV+PHEV) in Spain in 2024 against planning ambitions that imply more than 5 million EVs on the road by 2030, underlining the investment burden in infrastructure and industrial adaptation.

Against this, **digitalisation** is portrayed as a redefinition of the vehicle into a software-defined, connected computing platform. Respondents converge on the shift from distributed ECUs to consolidated high-performance compute nodes, enabling over-the-air updates, continuous feature evolution during ownership, remote diagnostics, and iteration cycles closer to consumer tech than traditional model-year change. Connectivity is treated as multi-directional (vehicle-to-vehicle, infrastructure, pedestrians, grid and wider networks) and linked to new value capture through data, while simultaneously elevating cybersecurity, privacy and data governance as core engineering and compliance disciplines. AI and big data are positioned as both product and operational levers: predictive maintenance and uptime improvements, automation of standard processes, faster decision-making, and industrial optimisation via digital twins, IoT integration and advanced robotics. Enabling technologies repeatedly cited include edge AI, semiconductors, simulation, and battery innovation—highlighting that the digital shift is increasingly constrained by compute capability and supply-chain access as much as by software talent.

Automation and autonomy are described as the longer-horizon transformation already visible through rapid expansion of ADAS and incremental steps from Level 2 upward, with aspirations to Level 3–4. The bottlenecks are not framed as "one breakthrough away" but as compounded demands in sensing and compute (camera/radar/LiDAR, fusion), safety performance, validation burden, and model-based/system-level engineering needed to manage complexity and liability. Autonomy is also

linked to changing mobility economics—urban shared services, smart-city integration and vehicle-as-a-service concepts—alongside commercial shifts such as more digital sales journeys, reduced reliance on traditional showrooms, consolidation among intermediaries, and experimentation with agency-style distribution.

A second cluster centres on geopolitics, **supply resilience and resource constraints**. Respondents describe a move from global optimisation toward regionalised value chains and localised production, driven by trade restrictions, protectionism and shock resilience. Raw materials, energy affordability and supply security recur as structural constraints shaping Europe's ability to scale batteries and components at competitive cost. Competitive pressure from low-cost entrants—explicitly including Chinese players—is treated as immediate and systemic, amplified by differences in industrial policy and scaling capacity. High development costs from rising product complexity, market volatility and uneven national readiness are presented as practical brakes on transition speed, even where regulatory direction is clear.

Talent is framed as a cross-cutting determinant of EU competitiveness that underpins the execution of every other trend. The shift "from mechanics to software" reallocates capability needs toward software engineering, systems integration, electronics, cybersecurity, AI and data—while keeping quality assurance and safety-critical engineering central as vehicles become sensor-rich and updateable. Skills shortages are described as already operational, slowing product cycles and weakening Europe's ability to keep pace with US and Asian competitors hiring for the same profiles; one synthesis cites that over 64% of European automotive employers struggle to fill engineering/AI/battery roles and that only ~42% of European R&D staff meet digital and analytics proficiency requirements (vs ~51% in North America). Soft skills are repeatedly emphasised as rising in importance under compressed timelines and higher complexity: leadership, teamwork, cross-functional coordination, critical thinking and continuous learning are treated as execution prerequisites, not "nice-to-have" training themes. A minority view nuances the narrative by arguing that regulation, investment climate, bureaucracy and cost pressure can outweigh talent as bottlenecks, and that Europe retains strong specialist engineering depth; even these positions still recognise that R&D and system-level integration remain talent-intensive.

Production outsourcing and rationalisation are expected to shift from pure cost optimisation toward risk-managed regionalisation, in other words, "best landed cost" giving way to "most trade-insulated cost." Near-sourcing and local-for-local manufacturing are anticipated to accelerate via regional hubs, micro-factories and co-location models that reduce lead times and transport exposure, while selective

outsourcing continues for non-strategic processes and cost-sensitive components to preserve flexibility. In parallel, respondents anticipate stronger insourcing/vertical integration for critical EV and software-defined vehicle technologies—batteries, semiconductors, high-voltage electronics, safety-critical ECUs and e-drive components—driven by supply security, IP protection, tighter hardware–software coupling and faster change cycles. Supplier bases are expected to be consolidated around fewer, more technologically capable partners while diversifying regionally to avoid single-country dependence, supported by digitally integrated "Outsourcing 4.0" models. Geopolitics and Chinese competition cut through these expectations: Chinese Tier 1s/OEMs with end-to-end control from materials to cells, software and assembly are seen as able to establish European plants while keeping technology and margins, raising the risk that Europe could end up hosting production without retaining commensurate know-how unless local players match electrification and connectivity capability at scale.

2. SKILLS AND ROLES FOR A CHANGING INDUSTRY

Training and workforce transformation are constrained first by execution capacity, not by lack of awareness. **Time is the binding limitation**: lean staffing, tight deadlines, and constant operational interruptions make it difficult to take people off the line without losing output or paying overtime, so training is postponed or reduced to fragmented, low-impact sessions. Funding pressure sits directly behind this; when volumes and margins soften, upskilling budgets are cut early, while public support is often too slow or administratively heavy for industrial timelines and may not cover mandatory programmes. These constraints compound a persistent mismatch between fast-changing needs and slow-moving training supply: external **curricula lag** electrification, batteries, ADAS, AI, cybersecurity, data, software-defined architectures, and modern CAD/CAE, forcing companies into internal buildouts that consume scarce experts. **Qualification and regulatory frictions** (uneven high-voltage frameworks, slow cross-border recognition) and labour rigidities further slow redeployment. Cultural factors amplify everything—ageing workforces, fear of automation-driven job loss, resistance to change, reluctance to relocate—especially where leadership still treats learning as an "extra" rather than part of operating design.

The **most critical skill gaps** cluster where **software, electrification and systems integration** intersect. Software capability is structurally undersupplied: embedded/vehicle software, connectivity, cybersecurity, data management, AI skills for product and operations, and competence in digital twins, edge/IoT and virtualised testing. Demand is highest for hybrid profiles combining software depth with automotive domain knowledge (AD/ADAS, connected EV platforms, diagnostics) and for system-level

thinking that bridges domains. Electrification adds broad gaps beyond engineering into factories and management layers: high-voltage safety, power electronics, battery/thermal management, charging-related competence, and electrical maintenance. Automation and smart manufacturing create a parallel cluster: industrial automation, PLC/robot programming, vision systems, mechatronics, sensor-based systems, and data-driven maintenance, with recurring weakness in practical troubleshooting and structured problem-solving. Alongside technical shortages, respondents stress "execution skills" under complexity—project/PLM capability, standards literacy, analytical discipline—and meta-skills (adaptability, continuous learning, cross-functional collaboration). AI literacy itself is a gap: many employees cannot yet use AI tools effectively or interpret outputs critically.

Over the next 5–10 years, the emerging skill agenda concentrates in three converging areas: electrified energy systems (high-voltage, batteries/BMS, thermal/energy management, charging, recycling/circularity), software-defined vehicles (embedded software, OTA, modern architectures, DevOps/CI-CD, model-based tools, simulation), and data-driven automation in engineering and production. Cybersecurity and functional safety are treated as unavoidable and front-loaded ("security by design"), because retrofits post-deployment are costly and sometimes impractical. **AI is the accelerant across all domains**—predictive optimisation, generative support for engineering/admin work, digital twins and AI-enabled AR for training and troubleshooting—raising the need for practical human–machine interaction competence and safety protocols.

Preparation **strategies are converging on portfolios rather than single fixes**: embedding continuous learning into daily work, mapping critical competencies, tailoring role-based pathways, and using simulation/digital twins/virtual training to scale reskilling without relying on physical prototypes. Companies combine targeted hiring of scarce experts with internal specialist teams and partnerships with universities, vocational schools, suppliers and consultancies, while shifting toward skill-based hiring and development (demonstrated competence and learning agility over formal credentials). The main gap is that implementation still depends on protected time, internal trainer capacity, and leadership-driven cultural change; some organisations admit that financial pressure leaves them without a coherent long-term plan.

Attracting tech talent is increasingly about repositioning automotive as a software-and-safety-critical systems industry with tangible real-world impact (autonomy, connectivity, AI, cybersecurity, electrification). Firms try to match tech-sector expectations where possible—hybrid work, modern digital tooling, clearer technical career paths, pay-for-skills—but often cannot match big-tech compensation, so they lean on product complexity, brand visibility and purpose. Many therefore

prioritise pipeline tactics: reskilling existing staff (VR/nano-degrees, modular platforms), partnerships with universities/startups/research centres, and skill-based recruitment.

Technology is used to reduce workforce inefficiency but is not seen as a shortcut. AI supports bottleneck detection, predictive maintenance, quality control, reporting and engineering automation; robotics stabilises repetitive work where volumes justify; digital twins support capacity/supply-chain simulation and safer training. Adoption is slowed by legacy IT, data quality, budgets and skills gaps, and can initially increase workload until processes and people adapt—reinforcing that change management and training are prerequisites, not afterthoughts.

Cybersecurity is treated as a **core safety and business risk** for connected vehicles, driving investment in governance (security requirements gating projects), dedicated teams, testing capabilities and VSOCs. The persistent issue is skills and integration: cybersecurity must be embedded across software, hardware, systems engineering and validation rather than isolated, and poor communication between cyber specialists and project teams can become a development bottleneck.

3. FUTURE WORKFORCE NEEDS – HOW MANY AND WHAT KIND?

Labour market conditions increasingly combine shortages and overcapacity within the same organisations and sites. The prevailing shortage is concentrated in advanced technical profiles—software engineering, AI, systems engineering, cybersecurity, microelectronics, battery and high-voltage domains, plant digitisation and industrial automation—alongside persistent gaps in workshop-critical operational roles such as electricians and maintenance technicians. These constraints reduce execution speed, delay industrialisation and R&D timelines, and increase dependence on external suppliers for prototyping and limited-series work. In parallel, overcapacity is building in legacy roles linked to combustion-engine technologies and traditional mechatronics, and in specific plants exposed to weaker demand or value-chain reallocation. **The dominant issue is therefore not absolute headcount, but skill mismatch: available capacity does not map to the pace and direction of technological change, limiting redeployment options and slowing transformation**.

The main workforce response is a shift toward structured conversion of existing capacity into expanding roles, supported by intensified internal training and external pipelines. Many organisations prioritise tailored learning pathways by role, partnerships with vocational providers and universities, and dual-training models that shorten time to productivity. Reskilling is widely treated as necessary but unevenly feasible, with outcomes dependent on starting qualifications, job realities, and the ability to release employees from production time. For ramp-ups and new product launches, temporary

labour remains a common stabiliser, typically combined with structured onboarding and short-cycle training to reach operational stability quickly. Flexibility mechanisms—agency work, time-bank or hour-bank scheduling, and internal redeployment—are used to absorb volatility and avoid costly downtime under collective arrangements. Cross-plant and cross-country mobility programmes are increasingly used to balance shortages and surpluses within multinational footprints.

Public-sector engagement is treated primarily as an operational lever to align candidate supply with quantified hiring needs, streamline selection processes, and mobilise workers released from other employers. Demographic pressures are expected to sustain tight labour markets in the medium term, making supply expansion structurally difficult. In this context, guided immigration and faster administrative pathways are frequently positioned as part of the solution, typically coupled with language and integration support. Automation is simultaneously accelerating as a direct response to labour constraints and cost pressure, with expectations of more robotised production over the next decade and wider deployment of AI tools to raise engineering throughput by reducing repetitive work; pilots are reported as promising, with scaling and use-case prioritisation the key bottlenecks.

Workforce stability is treated as a strategic requirement in scarce profiles and operational roles. Elevated turnover is reported in certain functions, driven by wage competition and perceived attractiveness of alternatives. High employer labour costs are frequently cited as a structural constraint on hiring and retention strategies. Mitigation focuses on internal mobility, clearer career pathways, flexible working conditions for critical profiles, and more deliberate employer branding. In a minority of cases, workforce conditions are described as stable, with low turnover and limited immediate retirement risk, but even these organisations prioritise skills monitoring and continuous training as risk insurance.

Overall workforce planning is increasingly framed as a single, integrated problem: quantify capability gaps, identify skills at risk of obsolescence, redesign roles to broaden task coverage, redeploy between lines and sites, and recruit externally only where capabilities cannot be built fast enough internally.

In parallel, organisations are adopting a hybrid model to balance global talent needs with localisation of manufacturing and strategic supply chains. Advanced digital competences remain concentrated in hubs with mature ecosystems, while production locations must become digitally fluent to operate smart factories. A majority view is that IT and manufacturing skills do not need full co-location but require tight functional integration: global or regional centres define architectures, standards and core platforms, while local teams execute factory integration, sustain operations, manage data flows, and address security-sensitive requirements close to production. The resulting workforce demand is less

about expanding overall headcount and more about **increasing the share of hybrid profiles** that combine domain knowledge in manufacturing with data, automation, and software literacy, supported by a smaller layer of highly specialised experts distributed across the European footprint.

4. MANAGING JOB LOSSES AND WORKFORCE TRANSITION

Workforce transition and restructuring in the European automotive industry are constrained by a tight combination of funding design, skills conversion limits, organisational frictions, and legal uncertainty. A majority report that **public support is uneven, slow to mobilise, and operationally hard to use**: grants are insufficient for large reskilling programmes, calls are fragmented rather than continuous, and eligibility, co-financing, and approval cycles introduce planning risk that does not match transformation timelines. This pushes many organisations toward staged, defensive measures instead of early, decisive redeployment and restructuring. At the same time, the skills gap between legacy roles and growth profiles—software, data/AI, cybersecurity, electrification, battery-related competencies, digital manufacturing, automation, and sustainability—remains wide. In practice, conversion often resembles near-academic retraining in depth, cost, and time, which limits feasibility for parts of the incumbent workforce and makes outcomes highly dependent on starting skill levels and role reality. **Training supply is frequently viewed as too generic and too slow to update**; **modular, work-compatible formats are still insufficient**, and internal subject-matter capacity is limited by lean staffing and delivery pressure. Internal mobility is further constrained by siloed structures, narrow job classifications, and the difficulty of transferring deep domain expertise into fundamentally different fields; external hiring does not fully compensate because scarce profiles carry high turnover risk and intensified competition.

Organisational and human factors materially slow the transition. Resistance to change, especially in long-tenured groups, reduces acceptance of redeployment and new operating models, particularly where automation is associated with job insecurity. **Time is a binding constraint**: production continuity, tight deadlines, and unfilled vacancies reduce training capacity and increase workload, weakening participation and reinforcing change fatigue. **Generational expectation gaps amplify this**: many younger candidates prioritise flexibility, hybrid work, and faster progression, while a substantial share of industrial roles remains shift-based and on-site. In some contexts, wage structures, labour cost levels, and tax wedges limit the ability to deliver competitive net pay, intensifying retention pressure in both operational and digital roles. As a result, restructuring is treated as a leadership and communication problem as much as a technical one, requiring credible pathways, consistent messaging, and active management of uncertainty and perceived fairness.

Regional authorities, education institutions, and employment services are expected to operate as a **coordinated transition system** with predictability as the baseline. A majority want earlier and clearer regulatory signals that allow workforce planning in line with electrification, software-defined vehicles, and evolving aftersales requirements, including pragmatic compliance timelines and standards that reflect new technologies. Education and training are expected to shorten feedback loops with industry through faster curriculum updates, stronger practice orientation, and formats that scale: modular short-cycle learning, micro-credentials, bootcamps, apprenticeships, internships, and structured school–work alternation governed by clear rules and fair pay. Stakeholders also want a strong general foundation complemented by flexible add-on modules that can be adjusted quickly as demand shifts. Funding and incentives are positioned as decisive for scale: streamlined access to European and national instruments, continuous schemes rather than one-off calls, and co-financing models that support both incumbent reskilling and modernisation of training provision. Region-level labour-market intelligence—skills forecasting, observatories, and data sharing—should guide training capacity, vouchers, and active labour policies. Views on employment services are split: a minority consider them ineffective and turn to private intermediaries despite cost; the preferred public model focuses on assessing transferable skills, offering personalised guidance, and building co-designed placement-and-training pathways with companies, with explicit attention to older cohorts and workers with limited mobility.

Work organisation remains structurally bifurcated. Hybrid and remote work is increasingly normal for software, electronics, and parts of engineering, while core shopfloor production remains predominantly on-site due to safety, quality, and line-continuity constraints. Limited flexibility is expanding at the edges through modular or part-time shifts and digitally enabled roles in monitoring, diagnostics, programming, and remote technical support, but high capital intensity and utilisation requirements constrain how variable staffing and working time can become without eroding viability. Hybrid work has nevertheless widened the talent pool for digital roles and improved attraction and retention where salary competition is constrained; collaboration is more tool-driven and standardised, while co-location remains critical for labs, prototyping, crisis resolution, and complex cross-functional problem-solving. Innovation benefits from distributed expertise and faster iteration, but risks include weaker cohesion and reduced informal exchange unless knowledge management and leadership practices are deliberately strengthened. Expectations for outsourcing and flexibility are moving toward selective, capability-driven use: a majority anticipate lower reliance on generic agency labour as task complexity increases and stable internal teams gain value, while specialised external capacity is expected to remain relevant for bounded activities such as prototyping, testing, and niche

software/AI tasks; core architecture, functional safety, and IP-critical knowledge are generally kept in-house. Overall, the transition trajectory is toward hybrid workforce architectures combining permanent employment, internal flexibility mechanisms, targeted external expertise, and improved skills visibility to enable faster redeployment under regulatory and market uncertainty.

5. CLOSING THE GAP – IS EDUCATION AND TRAINING KEEPING UP?

Education and training are not keeping pace with the workforce shift in the European automotive value chain, and employer coordination is not yet sufficient to close the gap at scale. Collaboration between regional employers is described as uneven: a minority of regions operate functioning ecosystems with clusters, municipalities, schools, universities, training centres and technology institutes, while a majority still show fragmented, company-by-company approaches with limited information sharing and little sustained joint planning. **Where cooperation exists, it is often project-based and time-limited**—frequently tied to EU or association initiatives—rather than governed as long-term, "pre-competitive" skills infrastructure. Effective mechanisms cited include regional clusters, dual-training centres, technical schools aligned to production needs, university–industry projects, specialised master's programmes, and vocational mobility schemes. However, governance, continuity, and scale are recurrent gaps, and competition for scarce profiles often discourages deeper collaboration, particularly among smaller suppliers with limited capacity to participate. Stakeholders consistently point to the need for structured coordination platforms, shared labour-market intelligence, common qualification metrics, co-funded training programmes, and stronger neutral conveners (clusters/associations), complemented by targeted measures to mobilise underused talent pools, including women in technical roles.

The most significant education and training gaps relate to the **speed of transformation**. Curricula and delivery models—across VET and parts of higher education—are frequently assessed as too slow and too anchored in traditional mechanical content while demand shifts toward software, electronics, data and energy systems. The most pronounced technical deficits cluster in software and digital capabilities (software engineering beyond classic embedded, embedded SW/HW integration, IT/network knowledge, data analytics, AI/ML, cybersecurity, connectivity), followed by electrification competencies (high-voltage safety, batteries and battery management, power electronics, thermal and energy management). Additional shortages are noted in functional safety, software-defined vehicle architectures and autonomy-related topics, alongside sustainability skills such as circularity and life-cycle methods. A second, cross-cutting gap is insufficient practical training: limited hands-on exposure, too few structured internships and shared labs, and insufficient instructor capacity with

current industrial experience. This drives demand for experiential and project-based learning formats, modular short-cycle training, micro-credentials, and personalised pathways that can be combined with work, as well as stronger recognition of competences acquired through practice. Soft-skill deficits are also repeatedly flagged, especially leadership, communication, systems thinking, resilience, and the ability to work under ambiguity in cross-functional and multicultural settings. Regional disparities remain significant, and weak translation mechanisms between academic outputs and deployable industrial value further reduce system effectiveness; in a minority view, the sector also struggles to attract and retain junior talent, reinforcing pipeline fragility.

Partnerships with universities, technical schools and, increasingly, bootcamps are widespread but uneven in depth and outcomes. A majority of large organisations report active collaborations ranging from long-standing relationships with vocational centres to extensive university networks, joint teaching, industry-led lectures, PhD schemes, and co-developed master's programmes in EV, mechatronics, connected and autonomous vehicles, and software engineering. The strongest models are concentrated in dense automotive regions where political and institutional support exists and where dual approaches combine classroom learning with structured in-company training. Many firms complement external partnerships with internal academies or bootcamps for embedded software, AI, and cybersecurity, using partnerships as primary hiring channels in key R&D locations. However, a minority report collaboration as ad-hoc, localised, or poorly promoted, with limited cross-border reach and persistent curriculum lag relative to SDV, AI, battery and connectivity developments. The dominant direction is a shift from theory-heavy pipelines toward agile, lifelong learning ecosystems built on faster skill-based qualification routes, scalable co-design with education providers, and shared infrastructure that reduces the burden on individual employers.

6. DELIVERING THE RIGHT SKILLS AT THE RIGHT TIME

Skills delivery in the European automotive sector is constrained by speed, portability, and operational relevance rather than by a lack of training activity. Credential recognition gaps are a material barrier where certification is legally required or mandated by safety, security, or OEM compliance; missing or non-recognised credentials can directly block task assignment and deployment. Outside regulated domains, the barrier is indirect but persistent: fragmented qualification systems across countries (and sometimes within them) reduce comparability and trust, limit cross-border mobility, and weaken the value of short-cycle offers. Bootcamps and micro-courses are widely used because they are fast and targeted, but they often do not translate into portable credits, recognised levels, or progression in job grading and pay structures, leaving modular learning weakly connected to career architecture. Many

companies therefore rely on internal academies and competence-based assessment; this works for skill transfer but reduces transferability and, for some workers, motivation. The prevailing remedy is simplification and standardisation: fewer, clearer, competence-based credentials that can "stack" modular learning into recognised qualifications across regions.

The dominant assessment is that education and training do not deliver required skills reliably enough or early enough for the pace of change. Classical foundations are viewed as broadly adequate, but gaps are growing in software-defined and digital domains (AI/data, cybersecurity, systems thinking, software engineering, hybrid engineering–IT profiles) and in electrification (high-voltage safety, battery systems, power electronics, thermal/energy management), with additional shortfalls in industrial digitalisation and sustainability methods. Practical exposure remains insufficient: too little hands-on learning, limited industrial-grade training environments, and shortages of up-to-date instructors slow improvement. Fragmentation of offers, uneven regional capacity, and inconsistent recognition further reduce scale and mobility. Priority fixes concentrate on tighter industry–education cooperation, more work-based learning, faster curriculum updates, modular short-cycle formats, and quicker skill-based certification; cost and risk-sharing is a constraint because employer-led training is often most relevant but expensive under tight margins and retention uncertainty.

ESG is increasingly embedded in governance and reporting, but the social pillar is less mature and unevenly operationalised. The strongest "S" measures are linked to employability and transition (internal reskilling, apprenticeships, modular learning), inclusion initiatives (notably women in technical roles, often via outreach and partnerships), and working conditions (ergonomics, high-voltage safety, and in some cases mental-health and psychological safety programmes), with some community engagement through education and training projects. Smaller firms often report limited ESG capability and high compliance complexity, amplified by cascading reporting demands from larger customers. A common gap is the distance between strategy and daily practice, with the social dimension still treated more as compliance than as an operational lever.

Public funding is viewed as strategically important and broadly aligned with clean mobility, digitalisation, and skills, particularly at EU level, but **frequently not fit for operational speed**. Access is often **bureaucratic and fragmented**, **visibility is limited**, and approval cycles **lag technology shifts**, especially in AI and digital transformation. Many schemes are seen as more supportive of R&D and pilots than of production deployment, aftersales transformation, or broad-based upskilling beyond R&D populations. Regional authorities and employment services influence workforce decisions

unevenly: some companies report limited day-to-day value due to slow, generic programmes, while others credit public frameworks and networks with enabling university collaboration, applied research, and large-scale lifelong learning initiatives. Engagement with universities and technical schools is widespread through internships, thesis projects, curriculum input, and co-designed training, but depth varies by region and company capacity; smaller suppliers are more constrained. Overall, firms want fewer, larger, longer-term instruments with simpler rules, faster deployment, and co-created training offers.

AI, automation, and robotics are expected to reduce routine tasks and expand roles requiring digital fluency, oversight, and problem-solving. Shopfloor work shifts toward supervision of automated systems, first-level maintenance, and data-supported decision-making with AI-assisted quality and collaborative robotics. In engineering and support functions, AI copilots automate documentation, analysis, simulation, and validation, pushing human work toward interpretation, system-level judgement, and governance. Growth roles concentrate in data, automation maintenance, AI enablement, and human–machine collaboration, increasing urgency for modular upskilling, digitally supported learning, and portable, competence-based credentials over the next 5–10 years.

CONCLUSION & KEY TAKEAWAYS

The interviews highlight that the mobility transition is not only a technological shift but a profound transformation of workforce structures, skills profiles, and organisational models across the European automotive ecosystem. Companies are simultaneously managing technological change, labour shortages, regulatory uncertainty, and increasing global competition, while trying to adapt their workforce capabilities at a pace that existing education, training, and policy frameworks struggle to match. Across the interviews, organisations consistently emphasise that the key challenge is not a lack of awareness of the skills transition, but the operational difficulty of delivering the right capabilities quickly enough while maintaining production continuity and competitiveness.

Companies are responding through a combination of internal reskilling, targeted recruitment, automation, and partnerships with education providers. However, the scale and speed of the transition expose structural constraints: limited training capacity, fragmented qualification systems, uneven regional collaboration, and workforce mobility barriers. Digitalisation, electrification, and automation are reshaping both shopfloor and engineering roles, increasing demand for hybrid profiles that combine domain knowledge in manufacturing with software, data, and automation capabilities. At the same time, parts of the existing workforce linked to legacy technologies face uncertain transition pathways, making workforce planning increasingly focused on redeployment, skills monitoring, and internal mobility.

Interviews also underline that skills development cannot be addressed by companies alone. Effective responses require stronger coordination between industry, education systems, and public institutions, faster curriculum adaptation, more practical and modular training formats, and funding mechanisms that align with the operational timelines of industrial transformation.

Key takeaways emerging from the interviews include:

- The mobility transition is fundamentally a **workforce transformation challenge**, requiring new capabilities in software, data, electrification, automation, and digital manufacturing across the value chain.

- **Hybrid skill profiles are becoming central**, combining manufacturing or engineering domain expertise with digital and software-related competences.

- **Reskilling existing workers is essential but difficult to scale**, as training requires significant time, funding, and foundational knowledge that not all workers possess.

- **Internal training and corporate academies are increasingly important**, often compensating for gaps in external training supply and slow curriculum updates.

- **Education and training systems struggle to keep pace** with technological developments, particularly in software-defined vehicles, AI, cybersecurity, battery systems, and industrial digitalisation.

- **Practical, work-based learning remains insufficient**, with companies calling for more internships, apprenticeships, shared training facilities, and project-based learning.

- **Regional cooperation between companies and education providers remains uneven**, with effective clusters existing in some regions but fragmented approaches in many others.

- **Credential recognition and qualification portability remain barriers**, limiting mobility and reducing the value of short-cycle training formats such as bootcamps and micro-credentials.

- **Labour shortages and demographic pressures are expected to persist**, increasing reliance on automation, guided immigration, and broader talent pools.

- **AI, automation, and robotics will reshape job roles rather than simply replace them**, shifting work toward system supervision, problem-solving, and digital decision-making.

- **Public funding and policy frameworks are viewed as important but often too slow or fragmented**, with companies calling for simpler, longer-term instruments aligned with industrial timelines.

Overall, the interviews point to a transition toward more flexible workforce architectures combining permanent employment, internal mobility, targeted external expertise, and continuous learning systems. The ability to align skills development with the speed of technological change will be a decisive factor in maintaining the competitiveness of the European automotive ecosystem during the mobility transition.