AUTO CREDIFY

FUTURE-READY SKILLS

OCCUPATIONAL AND LEARNING PATHWAYS

D5.1 Occupational and learning pathways for the twin transition

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Deliverable information

Report Title:	Occupational and learning pathways for the twin transition		
Responsible Project Partner:	ATEC	**Contributing Project Partners:**	Samiedu; Gobierno de Navarra

Document data:	**File name:**	AutoCredify - D5.1 Occupational and learning pathways		
	Pages:	33	**No. of annexes:**	2
	Status:	final	**Diss. Level:**	PU
Project title:	Accelerating automotive green and digital skills with micro-credentials		**GA No.:**	ERASMUS-EDU-2024-POL-EXP-MICRO-CRED
Project No.:	101196000		**Output No:**	D5.1
Date:	**Due Date:**	30.6.2026	**Submission date:**	30.6.2026
Keywords:	Twin Transition; Automotive Maintenance and Repair; Learning Pathways; Occupational Pathways; Electric Vehicle Technician; Automotive Mechatronics Specialist; Microcredentials; High-Voltage Systems; Skills Development; Stackable Learning.			
Review by:	ATEC (WP LEADER)		**Review date:**	22.06.2026
Approved by:	FGB (PROJECT COORDINATOR)		**Approval date:**	29.06.2026

For more information visit project's website.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Contents

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Executive Summary

The automotive maintenance and repair sector is experiencing profound transformation as a result of the twin transition, characterised by the increasing electrification of vehicle fleets and the growing integration of digital, electronic and software-enabled technologies. These developments are creating new competence requirements and accelerating the need for workforce upskilling and reskilling across Europe.

This deliverable, **D5.1 – Occupational and Learning Pathways for the Twin Transition**, presents the outcomes of Task 5.1 of the AutoCredify project. Building upon the skills anticipation activities conducted in Work Package 2 and the evidence gathered through the national analyses and stakeholder consultations undertaken in Work Package 3, the report identifies occupational development trends, analyses priority competence requirements and documents the learning pathways developed by the project partners in Finland, Spain and Portugal.

The analysis confirms a strong convergence across the three pilot countries regarding the skills challenges facing the automotive maintenance and repair sector. Stakeholders consistently identified electric vehicle technologies, high-voltage systems, battery technologies and advanced diagnostics as priority areas requiring targeted competence development. These findings justified the selection of two Automotive Skills Alliance (ASA) occupational profiles as common European reference frameworks: Electric Vehicle Technician (EVT) and Automotive Mechatronics Specialist (AMS).

Based on the identified skills needs, the report proposes a set of occupational pathways that reflect emerging professional development trajectories within the sector and analyses the learning pathways developed by the project partners. Although differing in structure and national implementation approaches, the learning pathways share a common progression logic, supporting the development of competences ranging from foundational awareness of electrified vehicle technologies to advanced high-voltage intervention and specialised technical expertise.

To strengthen comparability and transferability across countries, all learning pathways were integrated into the ASA Skills Hub and mapped against the competence requirements defined in the EVT and AMS skills cards. The analysis demonstrates particularly strong alignment with the EVT profile, reflecting the central role of electrification in shaping current workforce development priorities, while also highlighting the growing relevance of multidisciplinary competences associated with the AMS profile.

The report further examines the relationship between the learning pathways, national qualification frameworks and future microcredential development. While the pathways were developed as flexible and labour-market-oriented training solutions rather than formal qualifications, their modular structure, stackability and mechanisms for competence recognition and validation provide a strong foundation for future microcredential initiatives.

Finally, the report presents a set of recommendations intended to support the implementation of the project pilots. These recommendations emphasise the importance of prioritising electrification-related competences, using common occupational reference frameworks, testing stackable learning approaches, validating recognition mechanisms and collecting evidence to support future microcredential development.

Overall, the work undertaken within AutoCredify demonstrates that learning pathways aligned with occupational needs and supported by common European reference frameworks can provide an effective response to the skills challenges associated with the twin transition, while laying the foundations for more flexible, transferable and learner-centred approaches to workforce development within the automotive maintenance and repair sector

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

1. Introduction

1.1. Purpose of the Deliverable

The automotive maintenance and repair sector is undergoing a period of significant transformation driven by the twin transition, characterised by the simultaneous impact of digitalisation and the transition towards more sustainable and low-emission mobility solutions. The increasing adoption of electric and hybrid vehicles, the growing integration of electronics and software within vehicle systems, and the emergence of new diagnostic and maintenance requirements are reshaping occupational profiles and creating new competence demands across the sector.

In response to these developments, the AutoCredify project seeks to support the adaptation of the automotive workforce through the design and implementation of flexible learning solutions capable of addressing emerging skills needs. A key objective of the project is to explore how learning pathways and microcredentials can contribute to more responsive and accessible upskilling and reskilling opportunities for workers operating within the automotive maintenance and repair ecosystem.

This deliverable, **D5.1 – Occupational and Learning Pathways for the Twin Transition**, presents the results of the work carried out under Task 5.1. It identifies occupational development trends associated with the twin transition, analyses the competence requirements of selected occupational profiles and documents the learning pathways developed by the project partners in Finland, Spain and Portugal. The report also examines how these pathways can support stackable learning approaches and contribute to the future development of microcredentials within the sector.

The deliverable is intended to provide a common reference framework for subsequent project activities, particularly the design of microcredentials and the implementation of pilot activities, while also offering insights that may support future skills development initiatives within the automotive maintenance and repair sector.

1.2. Scope and Objectives

The scope of this deliverable covers the identification and analysis of occupational and learning pathways associated with the twin transition within the automotive maintenance and repair sector. The work focuses on the pilot countries participating in AutoCredify—Finland, Spain and Portugal—and builds upon the evidence gathered through the project's skills anticipation activities and country-level analyses.

The report examines how emerging technological developments are influencing occupational requirements and competence needs, with particular attention to the impact of vehicle electrification, high-voltage technologies, advanced diagnostics and increasingly integrated vehicle systems.

Two occupational profiles from the Automotive Skills Alliance (ASA) Skills Hub were selected as reference profiles for the analysis:

- Electric Vehicle Technician (EVT);
- Automotive Mechatronics Specialist (AMS).

These profiles provide a common European reference framework for understanding occupational developments and competence requirements associated with the twin transition.

The specific objectives of the deliverable are to:

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

- analyse the skills needs and occupational trends identified through the project's previous work;
- examine the relevance of the selected ASA occupational profiles within the automotive maintenance and repair sector;
- identify emerging occupational pathways associated with the twin transition;
- document and analyse the learning pathways developed by the project partners;
- explore the relationship between learning pathways, occupational development and competence requirements;
- examine the potential contribution of the learning pathways to stackable learning approaches and future microcredential development;
- provide recommendations to support pilot implementation and future skills development activities.

Through these objectives, the deliverable contributes to the overall aim of strengthening workforce preparedness for the technological and organisational changes affecting the automotive maintenance and repair sector

1.3. Methodological Approach

The methodological approach adopted in AutoCredify extends beyond the development of new learning content. The project seeks to establish an evidence-based methodology that connects labour-market intelligence, stakeholder engagement, occupational analysis and the future implementation of microcredential pilots to support the twin transition in the automotive maintenance and repair sector. Within this broader approach, Task 5.1 contributes by defining the occupational and learning pathways that will underpin the design and implementation of the project's pilot microcredentials.

Rather than being developed from a single source of evidence, the occupational and learning pathways presented in this report are the result of a triangulated methodology that combines complementary sources of information and validation. This approach ensures that the proposed pathways respond not only to current labour-market needs but also to emerging technological developments and the evolving competence requirements of the automotive maintenance and repair sector.

The methodological process builds progressively on the results generated across previous work packages.

First, the skills anticipation exercise conducted in Work Package 2 (WP2) provided a forward-looking understanding of the technological developments and labour-market trends shaping the future of the automotive maintenance and repair sector. Through the combined analysis of patent data and online job postings, the project identified emerging technologies, evolving occupational requirements and priority competence areas associated with the twin transition. This labour-market intelligence established the evidence base for defining the thematic focus of the occupational and learning pathways.

Second, the country reports developed in Work Package 3 (WP3) complemented this evidence by analysing the national policy frameworks, qualification systems, existing education and training provision, and the current maturity of microcredential-related initiatives in Finland, Spain and Portugal. The reports also examined the specific characteristics of each national automotive ecosystem, identifying existing skills gaps, emerging workforce needs and the opportunities and challenges associated with future competence development.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Third, the findings generated through WP2 and WP3 were discussed and validated through a series of international webinars, peer-learning activities, national workshops and stakeholder consultation sessions organised under Work Package 4 (WP4). These activities brought together representatives from industry, vocational education and training providers, sector organisations and other relevant stakeholders, enabling the project to validate the identified skills priorities, discuss emerging occupational trends and refine the proposed learning pathways according to practical labour-market needs. The consultation process also confirmed the strategic importance of competences related to vehicle electrification, high-voltage systems, battery technologies and advanced diagnostics, which consistently emerged as the principal priorities across the three pilot countries.

Finally, the project adopted the Automotive Skills Alliance (ASA) Skills Hub as its common European occupational reference framework. The Electric Vehicle Technician (EVT) and Automotive Mechatronics Specialist (AMS) occupational profiles were selected as the reference profiles for the analysis, providing a shared competence framework for identifying occupational pathways and mapping the learning pathways developed by the project partners. The subsequent integration of the learning pathways into the ASA Skills Hub strengthened their alignment with recognised European occupational profiles and enhanced their comparability across the participating countries.

Based on these complementary sources of evidence, the project partners designed national learning pathways that respond to identified labour-market needs while reflecting the specific characteristics of their education, training and qualification systems. Although developed independently within each national context, the pathways share common design principles, support progressive competence development and collectively contribute to the two selected ASA occupational profiles.

The methodological approach adopted in this deliverable therefore combines labour-market intelligence, national contextual analysis, stakeholder validation and European occupational reference frameworks to produce occupational and learning pathways that are evidence-based, labour-market relevant and internationally comparable. In doing so, it establishes the foundation for the subsequent implementation of the AutoCredify pilots, where these pathways will be translated into stackable microcredentials and their relevance, effectiveness and transferability will be evaluated in real learning and working environments..

2. Twin Transition and Skills Needs in the Automotive Maintenance and Repair Sector

2.1. Impact of Electrification

The automotive maintenance and repair (M&R) sector is undergoing a profound transformation driven by the increasing adoption of electric and hybrid vehicles. As vehicle manufacturers accelerate the transition towards low-emission mobility solutions, workshops, dealerships and independent repair providers are required to develop new technical capabilities that differ significantly from those traditionally associated with internal combustion engine vehicles.

Electrification is reshaping maintenance and repair activities in several ways. The growing presence of high-voltage systems, battery packs, power electronics, charging infrastructure and energy management systems requires technicians to acquire specialised knowledge and operate according to strict safety procedures. Tasks that were previously centred on mechanical systems increasingly involve electrical testing, battery diagnostics, safe isolation

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

procedures, software-assisted troubleshooting and compliance with standards governing work on high-voltage components.

The evidence collected through the AutoCredify country reports demonstrates strong convergence across the three pilot countries regarding the importance of electrification-related competences (AutoCredify D3.4, 2025). In Finland, demand is increasing for high-voltage safety, battery diagnostics, electric vehicle servicing and related safety-critical competences. The Finnish report also highlights that existing vocational provision remains strongly oriented towards conventional vehicle technologies, while advanced diagnostics, high-voltage safety and software-driven service processes are still covered unevenly (AutoCredify D3.4 – Finland Country Report, 2025).

In Spain, the transition towards electric, hybrid and connected vehicles is identified as a major driver of change across the automotive value chain. Electrification and climate-transition objectives are expected to generate new competence requirements in areas such as electric propulsion, batteries, charging systems, electromechanics, high-voltage systems and connected vehicle technologies. The Spanish report also stresses the need for significant workforce reskilling, including in downstream activities such as workshops, after-sales services and repair (AutoCredify D3.4 – Spain Country Report, 2025).

In Portugal, electrification is also identified as one of the main forces reshaping occupational profiles in automotive maintenance and repair. The country report highlights increasing demand for competences related to electric vehicle systems, high-voltage safety, battery technologies, diagnostics and environmental compliance. These developments are particularly relevant for SMEs and independent workshops, which need rapid and flexible upskilling solutions to maintain service capacity as vehicle technologies evolve (AutoCredify D3.4 – Portugal Country Report, 2025).

Across the three countries, electrification emerges as the most immediate and operationally relevant driver of skills demand. This provides a strong rationale for the development of learning pathways focused on electric vehicle maintenance, high-voltage safety, battery systems and advanced electrical diagnostics.

2.2. Impact of Digitalisation

Alongside electrification, digitalisation is transforming the technologies embedded in modern vehicles and the way maintenance and repair services are delivered. Contemporary vehicles integrate increasingly sophisticated electronic architectures, communication networks, software-controlled systems and advanced diagnostic functions. As a consequence, automotive maintenance activities require a growing combination of mechanical, electrical, electronic and digital competences.

Modern workshops rely extensively on digital diagnostic equipment, manufacturer-specific software, electronic service information systems and remote troubleshooting tools. Vehicle maintenance is becoming increasingly data-driven, with technicians expected to interpret diagnostic data, analyse fault codes, update software, calibrate electronic systems and interact with connected vehicle platforms.

The Finnish country report identifies growing demand for software-centric service processes, advanced diagnostics and competences related to Advanced Driver Assistance Systems (ADAS). These skills are increasingly connected to the maintenance of electric and hybrid vehicles, where electrical, electronic and software-based systems are highly integrated (AutoCredify D3.4 – Finland Country Report, 2025).

The Spanish report similarly highlights the increasing importance of digital connectivity, microelectronics, digitalisation, connected vehicle technologies and advanced diagnostics. It also points to competence gaps in areas

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

such as electric vehicle systems, ADAS calibration and cybersecurity, demonstrating that the digital transition is not limited to ICT-related occupations but directly affects technical roles within automotive maintenance and repair (AutoCredify D3.4 – Spain Country Report, 2025).

In Portugal, digitalisation is reflected in the increasing relevance of software-enabled diagnostics, digital service tools and emerging technological requirements associated with connected and electrified vehicles. These developments require technicians to move beyond traditional mechanical repair tasks and develop stronger diagnostic, analytical and digital problem-solving capabilities (AutoCredify D3.4 – Portugal Country Report, 2025).

The interaction between electrification and digitalisation is particularly evident in modern electric vehicles, where performance, safety, maintenance and repair increasingly depend on software-controlled systems and interconnected electronic components. As a result, future automotive professionals will require broader competence profiles that integrate electrical, electronic, diagnostic and digital capabilities alongside traditional maintenance skills.

2.3. Emerging Skills Needs Identified in the Pilot Countries

The country reports developed for Finland, Spain and Portugal reveal a high degree of convergence regarding the skills required to support the twin transition in the automotive maintenance and repair sector (AutoCredify D3.4, 2025). Although national VET systems, labour market structures and microcredential ecosystems differ across the three countries, stakeholders consistently identified a set of competence areas that are becoming increasingly important for technicians and service professionals.

The most relevant emerging skills needs relate to high-voltage safety, electric and hybrid vehicle maintenance, battery diagnostics, battery management systems, electrical and electronic fault diagnosis, software-supported diagnostics, ADAS calibration, connected vehicle technologies and compliance with evolving technical and safety standards (AutoCredify D3.4, 2025).

The evidence also suggests that employers are particularly concerned with the speed at which technological developments are occurring. Existing curricula and qualification structures often struggle to keep pace with changes introduced by vehicle manufacturers, new safety standards and evolving service procedures. This creates a gap between emerging competence requirements and available training provision.

A key finding emerging from the country reports is that stakeholder priorities tend to concentrate more strongly on electrification-related competences than on broader digitalisation topics. While both dimensions of the twin transition are recognised as important, the most urgent and immediate training needs identified by employers, training providers and sectoral stakeholders relate to electric vehicle technologies, high-voltage systems, battery-related competences and associated diagnostic procedures (AutoCredify D3.4, 2025).

This finding helps explain the strong focus on electrification within the learning pathways developed by the AutoCredify partners. The selected learning pathways respond directly to the most urgent needs identified in the pilot countries, while also incorporating digital and diagnostic elements where these are linked to electric, hybrid and connected vehicle maintenance.

The convergence of findings across Finland, Spain and Portugal provided a robust evidence base for the selection of the occupational profiles and learning pathways developed under AutoCredify. In particular, the identified skills priorities strongly support the relevance of the Electric Vehicle Technician and Automotive Mechatronics Specialist profiles as occupational responses to the twin transition in the automotive maintenance and repair sector.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

The skills needs identified across the three pilot countries informed the selection of the occupational profiles used as reference points for the development of occupational and learning pathways under AutoCredify. These profiles are presented in the following chapter.

3. Selection of Occupational Profiles

3.1. Occupational Profile Selection Methodology

The identification of occupational profiles for the AutoCredify project was guided by the objective of supporting the twin transition in the automotive maintenance and repair (M&R) sector through targeted upskilling and reskilling interventions. The selection process combined evidence gathered through the project's skills anticipation activities, country-level analyses and stakeholder consultations with existing European occupational intelligence resources.

The starting point for the selection process was the identification of emerging skills needs associated with the green and digital transitions. The country reports developed in Finland, Spain and Portugal highlighted the growing importance of competences related to electric and hybrid vehicle technologies, high-voltage systems, battery diagnostics, advanced diagnostics, connected vehicles and software-enabled maintenance processes (AutoCredify D3.4, 2025).

To ensure consistency and transferability across countries, the project did not develop new occupational profiles from scratch. Instead, it adopted existing job roles available through the Automotive Skills Alliance (ASA) Skills Hub. This approach enabled the project to build upon validated European occupational profiles that already reflect the evolving competence requirements of the automotive ecosystem.

The selection process therefore involved three main steps:

1. Identification of current and emerging skills needs through skills intelligence, labour market analysis and stakeholder consultation activities conducted under Work Packages 2 and 3.
2. Analysis of occupational trends and competence requirements associated with the twin transition in the automotive maintenance and repair sector.
3. Selection of the most relevant occupational profiles from the ASA Skills Hub capable of representing the competence needs identified across the pilot countries.

This process resulted in the selection of two occupational profiles that collectively capture the principal competence requirements emerging from the twin transition:

- Electric Vehicle Technician (EVT)
- Automotive Mechatronics Specialist (AMS)

Together, these profiles provide a comprehensive representation of the technological changes affecting automotive maintenance and repair activities. While the Electric Vehicle Technician profile focuses primarily on competences related to vehicle electrification and high-voltage systems, the Automotive Mechatronics Specialist profile reflects the increasing integration of electronics, diagnostics, software and intelligent vehicle technologies within maintenance and repair operations.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

3.2. Mapping National Skills Needs and Occupational Trends to ASA Job Roles

Although the pilot countries share common technological challenges, occupational structures and job titles vary considerably between national contexts. Different training systems, qualification frameworks and labour market traditions often use different terminology to describe similar professional activities.

The analysis conducted within AutoCredify revealed that many of the occupations identified by stakeholders and training providers in Finland, Spain and Portugal could be mapped to the two selected ASA occupational profiles, even where local job titles differed. In practice, employers frequently refer to specific functions such as high-voltage technician, EV maintenance technician, diagnostic technician or electric vehicle specialist rather than to standardised European occupational profiles.

To establish a common framework for the project, the ASA job roles were used as reference profiles against which national skills needs and learning pathways could be aligned. This harmonisation process enabled the project to compare training requirements across countries while maintaining a consistent European perspective.

Table 1 illustrates the relationship between the main competence areas identified through the country reports and the selected occupational profiles.

Table 1 - Mapping of identified skills needs to selected occupational profiles

Emerging Skills Needs	Electric Vehicle Technician	Automotive Mechatronics Specialist
High-voltage safety	✓	✓
Electric vehicle maintenance	✓	✓
Battery systems and diagnostics	✓	✓
Electrical fault diagnosis	✓	✓
Electronic systems maintenance	✓	✓
Software-enabled diagnostics	◐	✓
Vehicle communication systems	◐	✓
ADAS calibration and diagnostics	◐	✓
Connected vehicle technologies	◐	✓
Advanced troubleshooting	◐	✓

✓ = Core competence area; ◐ = Supporting competence area

The mapping exercise demonstrates that both occupational profiles address key aspects of the twin transition. However, the Electric Vehicle Technician profile is more directly aligned with the electrification-related priorities identified during stakeholder consultations, whereas the Automotive Mechatronics Specialist profile captures the growing importance of integrated electrical, electronic and digital competences.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

The selected ASA occupational profiles do not necessarily correspond directly to existing job titles used in the pilot countries. Instead, they provide a common European reference framework through which national occupational developments and learning pathways can be analysed and compared.

3.3. Electric Vehicle Technician

The Electric Vehicle Technician (EVT) profile was selected as one of the principal occupational profiles for the AutoCredify project due to its strong alignment with the skills priorities identified across the pilot countries. The increasing adoption of electric and hybrid vehicles is creating significant demand for technicians capable of maintaining, diagnosing and repairing electrified vehicle systems while operating safely in high-voltage environments.

The profile encompasses a broad range of activities related to the inspection, maintenance, testing and repair of electric vehicles and their associated electrical and electronic systems. Technicians working in this role are expected to possess specialised knowledge of battery technologies, high-voltage components, charging systems and vehicle energy management systems.

The profile is particularly relevant to the green transition, as it supports the growing deployment of low-emission vehicle technologies and contributes to the development of a workforce capable of servicing increasingly electrified vehicle fleets.

Key competence areas associated with the profile include:

- High-voltage safety procedures;
- Electric vehicle architecture and operation;
- Battery systems and battery diagnostics;
- Charging systems and infrastructure;
- Electrical testing and fault diagnosis;
- Preventive and corrective maintenance of EV systems;
- Safe handling of electrical and electronic components;
- Use of digital diagnostic tools.

These competence areas closely reflect the priorities identified by stakeholders in Finland, Spain and Portugal, making the Electric Vehicle Technician profile a particularly suitable reference point for the design and analysis of the project's learning pathways.

The profile therefore provides an appropriate framework for analysing the occupational trajectories emerging from the learning pathways focused on electric vehicle maintenance, high-voltage systems and battery-related technologies that were identified across the pilot countries.

3.4. Automotive Mechatronics Specialist

The Automotive Mechatronics Specialist (AMS) profile was selected to represent the growing convergence of mechanical, electrical, electronic and digital technologies within the automotive maintenance and repair sector.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Modern vehicles increasingly rely on integrated systems in which mechanical components interact continuously with sensors, electronic control units, communication networks and software applications. As a result, maintenance professionals require a broader and more multidisciplinary competence profile than in the past.

The Automotive Mechatronics Specialist profile reflects this evolution by combining advanced diagnostic capabilities with knowledge of vehicle electronics, communication systems and intelligent vehicle technologies. The profile therefore captures many of the competence requirements associated with the digital dimension of the twin transition while remaining firmly rooted in maintenance and repair activities.

Key competence areas associated with the profile include:

- Advanced vehicle diagnostics;
- Electronic control systems;
- Vehicle communication networks;
- Software-assisted troubleshooting;
- Calibration and configuration procedures;
- Sensor technologies and intelligent systems;
- ADAS-related technologies;
- Integration of electrical, electronic and mechanical systems.

Although the stakeholder consultations conducted in the pilot countries placed greater emphasis on electrification-related competences, the Automotive Mechatronics Specialist profile remains highly relevant for the future development of the sector. As vehicles become increasingly connected, software-driven and electronically controlled, demand for professionals capable of diagnosing and maintaining complex mechatronic systems is expected to continue growing.

The profile also provides an important framework for interpreting the growing relevance of advanced diagnostics, electronics, software-enabled maintenance and intelligent vehicle systems across the automotive maintenance and repair sector. While not all of these competence areas are explicitly addressed by the pilot learning pathways, they represent a critical direction for the future evolution of workforce skills.

Together, the Electric Vehicle Technician and Automotive Mechatronics Specialist profiles provide a coherent European occupational framework for addressing the skills challenges arising from the twin transition in the automotive maintenance and repair sector. In the following chapter, these profiles are used as reference points to analyse the occupational trajectories emerging from the learning pathways developed in Finland, Spain and Portugal.

4. Occupational Pathways for the Twin Transition

4.1. Occupational Pathways: Concept and Purpose

The twin transition is reshaping occupational requirements across the automotive maintenance and repair sector. Electrification, digitalisation and the increasing integration of software-enabled systems are transforming both the nature of maintenance activities and the competences required by automotive professionals. As a result, traditional

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

occupational boundaries are becoming less distinct, while new specialisations and career development opportunities are emerging.

Within the context of AutoCredify, occupational pathways are understood as potential professional development trajectories that reflect the evolution of skills, responsibilities and specialisation areas within the automotive maintenance and repair sector. They provide a structured representation of how workers may progress from traditional maintenance roles towards more specialised functions associated with electric vehicles, high-voltage systems, advanced diagnostics and intelligent vehicle technologies.

Occupational pathways were not formally defined as part of the project activities. Therefore, the pathways presented in this chapter were derived from the analysis of country reports, stakeholder consultations, identified skills needs and the learning pathways developed by project partners. They are intended to illustrate emerging occupational developments rather than prescribe formal career structures.

The analysis presented in this chapter seeks to identify common occupational trends across Finland, Spain and Portugal and to examine how these trends relate to the selected Automotive Skills Alliance occupational profiles introduced in Chapter 3.

4.2. Finland: Occupational Evolution and Skills Priorities

The Finnish country report highlights the rapid transformation of the automotive maintenance sector as a result of electrification, increasing vehicle complexity and the growing importance of software-driven maintenance processes (AutoCredify D3.4, 2025).

Stakeholders identified significant demand for competences related to electric vehicle servicing, battery diagnostics, high-voltage safety, advanced diagnostics and ADAS technologies. At the same time, concerns were raised regarding the limited coverage of these topics within existing vocational education and training provision.

The learning pathways developed in Finland reflect a progressive occupational development model that combines electrical, electronic and vehicle-specific competences. The progression from Automotive Electromechanic to EV Maintenance Technician, High-Voltage Technician and ultimately High-Voltage Specialist illustrates a clear pathway towards increasing levels of specialisation in electrified vehicle technologies.

This progression suggests an occupational trajectory in which traditional automotive technicians gradually acquire advanced competences in electrical systems, electric vehicle maintenance and high-voltage intervention procedures, enabling them to perform increasingly specialised tasks within modern workshops.

The Finnish case demonstrates a strong emphasis on professional progression through competence accumulation, particularly in areas directly associated with vehicle electrification and safety-critical operations.

4.3. Spain: Occupational Evolution and Skills Priorities

The Spanish country report identifies electrification, connected mobility, digitalisation and environmental objectives as key drivers of transformation within the automotive ecosystem (AutoCredify D3.4, 2025). The report highlights the growing importance of electric propulsion systems, battery technologies, charging infrastructure, digital connectivity and advanced vehicle technologies.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Stakeholder consultations emphasised the need to strengthen competences related to electric and hybrid vehicle maintenance, high-voltage systems, batteries, electronics, ADAS technologies and connected vehicles. Particular attention was given to the need for upskilling and reskilling initiatives capable of supporting the transition towards new mobility solutions.

The learning pathways developed in Spain reflect this evolution. The progression from safety and maintenance activities for electric and hybrid vehicles towards specialised competences in high-voltage systems and advanced electric vehicle technologies illustrates a gradual move towards greater technical complexity and specialisation.

The Spanish perspective highlights the emergence of professionals capable of working across multiple technological domains, combining electrical, electronic and diagnostic competences to support the maintenance and repair of increasingly sophisticated vehicle systems.

The occupational trends identified in Spain therefore point towards a workforce that is progressively moving beyond traditional mechanical maintenance and towards integrated technical roles associated with electric, connected and intelligent vehicles

4.4. Portugal: Occupational Evolution and Skills Priorities

In Portugal, stakeholder consultations highlighted electrification as one of the most significant drivers of change affecting the automotive maintenance and repair sector (AutoCredify D3.4, 2025). Particular emphasis was placed on high-voltage safety, electric vehicle maintenance, battery systems and diagnostics.

The occupational developments observed in Portugal reflect the growing need for technicians capable of working safely on electrified vehicles while complying with increasingly demanding technical and safety requirements. The importance of high-voltage qualifications and specialised training was repeatedly emphasised by stakeholders.

The learning pathways developed in Portugal mirror this occupational reality. The progression from foundation-level competences to Instructed Person in Electricity, High-Voltage Technician and High-Voltage Specialist reflects a structured pathway based on increasing levels of responsibility, technical complexity and authorisation to work on high-voltage systems.

This pathway closely aligns with recognised industry practices and demonstrates how automotive professionals can progressively develop the competences required to operate within increasingly electrified working environments.

The Portuguese case highlights the importance of structured competence development and specialised qualifications as mechanisms for supporting workforce adaptation to the challenges associated with electric vehicle technologies.

4.5. Cross-Country Occupational Convergence

Despite differences in national training systems, qualification structures and occupational terminology, the analysis of Finland, Spain and Portugal reveals a significant degree of convergence regarding occupational developments within the automotive maintenance and repair sector.

Across all three countries, stakeholders identified similar technological drivers of change and highlighted comparable competence requirements. In particular, the following themes emerged consistently:

- Electrification of vehicle fleets;

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

- High-voltage safety and intervention procedures;
- Battery technologies and battery diagnostics;
- Electrical and electronic systems maintenance;
- Advanced diagnostic capabilities;
- Increasing integration of software-enabled technologies;
- Growing complexity of vehicle systems.

The analysis also reveals common patterns of professional development. Although the learning pathways and qualification structures differ across countries, they consistently describe a progression from traditional automotive maintenance competences towards more specialised knowledge and skills associated with electric vehicles, high-voltage systems and advanced diagnostics.

Rather than establishing direct equivalence between occupations, it is therefore possible to identify common stages of professional development that are reflected in the national learning pathways and skills priorities.

Table 2 - Convergence of professional development stages across the pilot countries

Finland	**Spain**	**Portugal**	**Common Development Stage**
Automotive Electromechanic	Safety and Maintenance of Electric and Hybrid Vehicles	Foundation Level	Foundation Competences
EV Maintenance Technician	Safety and Maintenance of Electric and Hybrid Vehicles	Instructed Person in Electricity	EV Readiness
High-Voltage Technician	HV Electrical Systems: Testing and Maintenance	High-Voltage Technician	High-Voltage Operations
High-Voltage Specialist	Advanced EV Systems	High-Voltage Specialist	Advanced EV Specialisation

The comparison highlights a common logic of progression across the three pilot countries. The first stage focuses on the acquisition of core automotive maintenance competences and the development of awareness regarding electrified vehicle technologies. This is followed by the development of competences enabling professionals to work safely around electric and hybrid vehicles and to understand the specific characteristics of electrified systems.

The next stage involves the acquisition of specialised competences related to high-voltage systems, including testing, maintenance, diagnostics and safe intervention procedures. Finally, the most advanced stage is characterised by specialised expertise in electric vehicle technologies, advanced diagnostics and complex high-voltage operations.

Although the terminology and training structures vary, the progression patterns identified across Finland, Spain and Portugal demonstrate a shared understanding of how automotive professionals are expected to develop their competences in response to the twin transition. These common development stages provide a useful foundation for identifying broader occupational pathways that can be aligned with European occupational reference profiles and support the design of transferable learning solutions across countries.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

4.6. Emerging Occupational Pathways and Alignment with ASA Occupational Profiles

The cross-country analysis reveals two broad occupational development trajectories associated with the twin transition in the automotive maintenance and repair sector. These trajectories provide a useful framework for interpreting the occupational changes observed across the pilot countries and for understanding the relevance of the selected ASA occupational profiles.

Occupational Pathway 1: Electrified Vehicle Maintenance

The first pathway reflects the strong emphasis placed by stakeholders on electrification-related competences. It represents the progression from traditional automotive maintenance roles towards increasingly specialised functions associated with electric vehicles, high-voltage systems and battery technologies.

A simplified representation of this pathway can be described as follows:

Automotive Maintenance Technician → EV Maintenance Professional → High-Voltage Technician → Advanced EV Specialist

This occupational trajectory is strongly aligned with the ASA Electric Vehicle Technician (EVT) profile. The competence areas emphasised throughout the national pathways—including high-voltage safety, battery diagnostics, charging systems, electrical testing and electric vehicle maintenance—correspond closely to the competences defined within the EVT occupational profile.

The prominence of this pathway reflects the priorities identified through stakeholder consultations and explains why many of the learning pathways developed within AutoCredify focus primarily on electrification-related skills.

Occupational Pathway 2: Intelligent Vehicle Diagnostics and Mechatronics

The second pathway reflects the increasing integration of electronics, diagnostics, software and intelligent vehicle systems within automotive maintenance activities.

A simplified representation of this pathway can be described as follows:

Automotive Maintenance Technician → Electronic and Diagnostic Specialist → Automotive Mechatronics Specialist

This trajectory is closely aligned with the ASA Automotive Mechatronics Specialist (AMS) profile. Competence areas such as advanced diagnostics, electronic systems, software-enabled troubleshooting, communication networks and intelligent vehicle technologies are central to this occupational pathway.

Although less explicitly represented within the national learning pathways, the increasing complexity of vehicle systems and the growing importance of digital technologies indicate that this pathway is likely to become increasingly relevant in the coming years.

Convergence of Occupational Pathways

The analysis also suggests that the distinction between these pathways may become less pronounced over time. Modern vehicles are simultaneously electrified, connected and software-driven, requiring professionals to combine competences traditionally associated with both occupational trajectories.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

As a result, future workforce development is likely to require professionals capable of integrating competences associated with both the Electric Vehicle Technician and Automotive Mechatronics Specialist profiles.

Together, these two occupational pathways provide a coherent interpretation of the occupational developments associated with the twin transition and reinforce the relevance of the selected ASA occupational profiles as European reference frameworks for the automotive maintenance and repair sector.

The occupational trends identified across the pilot countries provided the basis for the design of the national learning pathways analysed in the following chapter. These learning pathways represent practical training responses aimed at supporting the competence development required by both the identified national needs and the selected ASA occupational profiles.

5. Learning Pathways Supporting the Twin Transition Occupational Profiles

5.1. Learning Pathway Design Principles

The learning pathways developed within AutoCredify were designed to support workforce upskilling and reskilling in response to the twin transition affecting the automotive maintenance and repair sector. Building upon the skills needs identified through the country reports and stakeholder consultations, the pathways provide structured training opportunities focused on the competences required to support increasing levels of vehicle electrification and digitalisation.

Although developed within different national contexts, the learning pathways share a number of common design principles. First, they follow a progressive structure that enables learners to develop competences incrementally, moving from foundation-level knowledge towards increasingly specialised technical capabilities. Second, they are modular in nature, allowing learners to acquire specific competences through shorter training units that can be combined into broader learning pathways. Third, they support the concept of stackability, whereby the successful completion of individual learning units contributes to broader competence development and occupational progression.

The pathways were also designed to respond directly to labour market needs identified by employers, sectoral stakeholders and training providers. Particular emphasis was placed on electric vehicle technologies, high-voltage systems, battery technologies, diagnostics and safe intervention procedures, reflecting the priorities identified across the pilot countries.

Finally, the learning pathways were conceived as potential foundations for the future development of microcredentials, supporting greater flexibility, recognition of learning achievements and lifelong learning opportunities within the automotive sector

5.2. Learning Pathways Developed in Finland

The Finnish learning pathways were designed to support the progressive development of competences associated with electric vehicle maintenance and high-voltage technologies. Together, they form a structured progression route

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

enabling automotive professionals to move from general electromechanical competences towards advanced specialisation in electrified vehicle systems.

Automotive Electromechanic

Duration: 50 hours

This pathway provides learners with a foundation in automotive electrical and electronic systems. It focuses on the integration of mechanical, electrical and electronic competences required to work with modern vehicle technologies.

The pathway serves as an entry point for professionals seeking to develop competences relevant to electrified vehicles and increasingly complex vehicle architectures.

EV Maintenance Technician

Duration: 40 hours

This pathway focuses on the maintenance and servicing of electric vehicles. Learners develop competences related to electric vehicle architecture, battery technologies, charging systems and maintenance procedures.

The pathway prepares technicians to work safely and effectively with electric vehicles while understanding the operational characteristics of electrified propulsion systems.

High-Voltage Technician

Duration: 40 hours

This pathway develops competences related to the testing, maintenance and diagnosis of high-voltage systems used in electric vehicles.

Particular emphasis is placed on safety procedures, risk management, system testing and practical intervention techniques required when working with high-voltage components.

High-Voltage Specialist

Duration: 30 hours

The most advanced Finnish pathway focuses on specialised intervention in complex high-voltage systems. Learners develop advanced diagnostic and troubleshooting capabilities together with deeper understanding of vehicle electrical architectures.

This pathway supports the development of highly specialised professionals capable of performing complex maintenance and repair activities within electrified vehicle environments.

5.3. Learning Pathways Developed in Spain

The Spanish learning pathways focus on electric and hybrid vehicle technologies, high-voltage systems and advanced vehicle subsystems associated with electrified mobility. The pathways reflect the priorities identified through stakeholder consultations, particularly the growing need for specialised competences related to electric propulsion, battery technologies, high-voltage safety and the maintenance of increasingly sophisticated vehicle systems.

Safety and Maintenance of Electric and Hybrid Vehicles

Duration: 70 - 100 hours

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

This pathway provides learners with fundamental knowledge and practical competences related to electric and hybrid vehicle technologies.

Key topics include vehicle safety procedures, maintenance practices, basic electrical systems, battery technologies and the operational principles of electric and hybrid vehicles.

The pathway provides an important foundation for technicians beginning to work with electrified vehicle technologies and supports the development of the competences required to safely perform maintenance activities on electric and hybrid vehicles.

HV Electrical Systems: Testing and Maintenance

Duration: 40 - 60 hours

This pathway develops competences related to the testing, maintenance and diagnosis of high-voltage electrical systems.

Learners acquire practical skills associated with safe intervention procedures, system testing, fault diagnosis and maintenance activities involving high-voltage components and associated electrical systems.

The pathway supports the development of professionals capable of performing specialised work on electric vehicle electrical systems while complying with the safety requirements associated with high-voltage environments.

Advanced EV Systems: Thermal & Regenerative

Duration: 100 - 140 hours

This advanced pathway focuses on specialised vehicle systems that are critical to the operation, efficiency and safety of electric vehicles.

The curriculum covers the maintenance of regenerative braking systems, hydraulic braking systems and ABS technologies, while providing a detailed understanding of the operation of electromechanical servo brakes and pressure accumulators. Learners also develop knowledge of three-phase propulsion modules, power electronics and auxiliary battery support systems, together with an understanding of the interaction between electric and hydraulic deceleration systems through brake blending technologies.

A significant emphasis is placed on the use of advanced measuring and testing equipment to support assembly, maintenance, verification and adjustment procedures. The pathway therefore contributes to the development of highly specialised technical competences associated with complex electric vehicle systems and integrated electromechanical technologies.

5.4. Learning Pathways Developed in Portugal

The Portuguese learning pathways were designed to support the development of competences associated with the safe operation, maintenance and intervention of electrified vehicles and high-voltage systems. The pathways follow a progressive structure inspired by recognised industry practices and qualification frameworks for work on high-voltage vehicle technologies.

Compared with the Finnish and Spanish approaches, the Portuguese pathways place a particularly strong emphasis on safety, authorisation and competence validation for professionals working on high-voltage systems. This reflects the priorities identified during stakeholder consultations, which highlighted high-voltage safety and specialised intervention procedures as critical competence areas for the future workforce.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Instructed Person in Electricity

Duration: 3 hours (online)

This training module represents an intermediate preparatory level and serves as an important entry point for professionals transitioning towards work on electric and hybrid vehicles.

It aims to help automotive repair professionals understand the general operating principles of electric and hybrid vehicles, recognise the risks associated with these technologies and adopt appropriate safety measures when working in electrified vehicle environments.

By focusing on awareness, risk prevention and safe working practices, establishes the foundation required for progression towards more advanced high-voltage qualifications.

High-Voltage Technician (HVT)

Duration: 32 hours (+ prior-learning validation through competence assessment)

This pathway provides training in accordance with DGUV 209-093 requirements for working on vehicles equipped with high-voltage systems. The programme covers certified procedures for establishing the absence of voltage and safely restoring voltage to the vehicle following maintenance or repair activities.

The pathway combines theoretical and practical training and concludes with both theoretical and practical examinations conducted on a high-voltage vehicle. Successful participants obtain certification as a **High-Voltage Technician (HVT – EFffT)**.

The pathway represents the principal qualification route for professionals expected to perform maintenance and intervention activities on high-voltage vehicle systems.

High-Voltage Specialist (HVE)

Duration: 24 hours

This pathway represents an advanced level of specialisation for professionals already qualified to work on high-voltage vehicle systems.

The programme focuses on specialised interventions involving advanced diagnostics, battery-related operations and complex high-voltage system interventions. It supports the development of advanced technical competences required for specialist roles associated with electrified vehicle technologies.

As electric vehicle technologies continue to evolve, this pathway provides an important route towards advanced technical specialisation within the automotive maintenance and repair sector

5.5. Alignment of Learning Pathways with Occupational Development Stages

The learning pathways developed across the three pilot countries closely reflect the occupational development stages identified in Chapter 4. Although the structure and terminology of the pathways differ, they collectively support a common progression from foundational competences towards advanced specialisation in electric vehicle and high-voltage technologies.

The first stage focuses on the acquisition of foundational knowledge and awareness related to vehicle electrification, safety principles and the basic operation of electric and hybrid vehicles. This stage is represented by pathways

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

such as **Automotive Electromechanic** in Finland, **Safety and Maintenance of Electric and Hybrid Vehicles** in Spain and **Instructed Person in Electricity** in Portugal.

The second stage supports the development of competences required to perform maintenance activities on electrified vehicles and to work safely with electrical systems. This includes pathways such as **EV Maintenance Technician** in Finland and the Spanish pathway **Safety and Maintenance of Electric and Hybrid Vehicles**, which introduce learners to the maintenance requirements and operational characteristics of electric and hybrid vehicles.

The third stage involves specialised competences associated with high-voltage systems, including testing, maintenance, diagnostics and safe intervention procedures. This stage is represented by **High-Voltage Technician** in Finland, **HV Electrical Systems: Testing and Maintenance** in Spain and **High-Voltage Technician (HVT)** in Portugal.

The final stage focuses on advanced technical specialisation. In Finland and Portugal, this is represented by the **High-Voltage Specialist** pathway, while in Spain it is represented by **Advanced EV Systems: Thermal & Regenerative**, which addresses advanced propulsion systems, power electronics, regenerative braking technologies and the use of specialised measuring and testing equipment.

Despite differences in training structures and qualification approaches, the three national models demonstrate a common logic of progression. Learners move from basic awareness and safety competences towards increasingly specialised capabilities associated with electric vehicle technologies, high-voltage systems and advanced technical intervention.

Taken together, the learning pathways provide practical and labour-market-oriented responses to the occupational developments identified across the pilot countries and support workforce adaptation to the technological changes associated with the twin transition.

5.6. Contribution to ASA Occupational Profiles

In addition to addressing national workforce development needs, the learning pathways developed within AutoCredify were integrated into the Automotive Skills Alliance (ASA) Skills Hub. This integration enabled the mapping of the learning pathways against the ASA occupational framework and, more specifically, against the competence requirements defined within the **Electric Vehicle Technician** (EVT) and **Automotive Mechatronics Specialist** (AMS) skills cards.

The mapping exercise provided a structured mechanism for analysing the contribution of each learning pathway to the selected occupational profiles and ensured consistency with a recognised European sectoral skills framework. It also strengthened the comparability and transferability of the learning pathways across national contexts, while providing an important foundation for future microcredential development and recognition.

While the national learning pathways were developed within different contexts and with varying levels of occupational specificity, their integration into the ASA Skills Hub enabled a systematic analysis of their contribution to the competence requirements associated with the EVT and AMS occupational profiles.

The analysis demonstrates strong overall alignment with both profiles, although the degree of contribution varies according to the focus and level of specialisation of each pathway..

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Table 3 - Contribution of learning pathways to ASA occupational profiles

Learning Pathway	Country	Contribution to EVT	Contribution to AMS
Automotive Electromechanic	Finland	Medium	Medium
EV Maintenance Technician	Finland	High	Medium
High-Voltage Technician	Finland	Very High	Low
High-Voltage Specialist	Finland	Very High	Medium
Safety and Maintenance of Electric and Hybrid Vehicles	Spain	High	Medium
HV Electrical Systems: Testing and Maintenance	Spain	Very High	Medium
Advanced EV Systems: Thermal & Regenerative	Spain	High	High
Instructed Person in Electricity	Portugal	Medium	Low
High-Voltage Technician (HVT)	Portugal	Very High	Medium
High-Voltage Specialist (HVE)	Portugal	Very High	Medium

The analysis reveals particularly strong alignment with the **Electric Vehicle Technician** profile. This result is consistent with the findings presented in the country reports and reflects the emphasis placed by stakeholders on competences related to electric vehicles, high-voltage systems, battery technologies, electrical diagnostics and safe intervention procedures.

Across the three pilot countries, the majority of learning pathways were designed to support competence areas that are central to the EVT profile, including electric vehicle maintenance, high-voltage safety, battery-related operations and specialised intervention procedures. This reflects the dominant role that electrification currently plays in shaping skills demand within the automotive maintenance and repair sector.

The contribution to the **Automotive Mechatronics Specialist** profile is generally lower but remains significant across several pathways. In particular, the Spanish pathway **Advanced EV Systems: Thermal & Regenerative** demonstrates a strong contribution to the AMS profile due to its focus on integrated electromechanical systems, regenerative and hydraulic braking technologies, power electronics, propulsion systems and the use of advanced measuring and testing equipment. These competence areas closely reflect the multidisciplinary nature of automotive mechatronics and the increasing integration of mechanical, electrical and electronic systems within modern vehicles.

The Finnish pathway **Automotive Electromechanic** and several of the advanced pathways developed across the pilot countries also contribute to AMS-related competence areas through their emphasis on diagnostics, electrical systems, troubleshooting and integrated vehicle technologies.

Overall, the mapping exercise confirms that the learning pathways developed within AutoCredify provide substantial coverage of the competence requirements associated with both selected ASA occupational profiles. The stronger

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

alignment observed with the EVT profile reflects the priorities identified through stakeholder consultations and labour market analysis, while the contribution to the AMS profile highlights the growing importance of integrated technical competences within increasingly complex vehicle systems.

The integration of the learning pathways into the ASA Skills Hub therefore provides an important bridge between national training solutions and European occupational frameworks, supporting transparency, comparability and future recognition of learning achievements across the automotive ecosystem.

6. Linking Learning Pathways to Qualifications Frameworks and Microcredentials

The previous chapters analysed the occupational profiles selected for the project, the occupational development trends emerging across the pilot countries and the learning pathways designed to address the identified skills needs. Together, these elements provide a coherent response to the workforce challenges associated with the twin transition in the automotive maintenance and repair sector.

However, the long-term value of these learning pathways depends not only on their relevance to labour market needs but also on their capacity to support flexible learning, lifelong upskilling and the recognition of acquired competences. As vocational education and training systems across Europe continue to evolve, increasing attention is being given to approaches that allow learning achievements to be accumulated, recognised and combined in ways that support individual career development and organisational competitiveness.

This chapter therefore examines how the learning pathways developed within AutoCredify relate to existing qualification frameworks, how they support the principle of stackability and how they may contribute to future microcredential developments. The analysis also explores the European added value of adopting common occupational reference profiles while maintaining responsiveness to national labour market needs and training systems.

6.1. Relationship Between Learning Pathways and National Qualification Frameworks

The learning pathways developed within AutoCredify were designed primarily as flexible and labour-market-oriented training responses to the skills challenges associated with the twin transition. As such, they should not be understood as formal qualifications within the national qualification systems of the pilot countries. Instead, they represent targeted learning opportunities aimed at addressing emerging competence needs that may not yet be fully reflected in existing qualification structures.

The analysis conducted in the country reports highlighted that the development and implementation of microcredentials remains at different stages across the three pilot countries. While national qualification systems provide important frameworks for vocational education and training, dedicated mechanisms for the recognition and integration of microcredentials are still evolving.

Finland

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

In Finland, the learning pathways complement existing vocational education and training provision by addressing emerging competence requirements associated with vehicle electrification, high-voltage systems and electric vehicle maintenance. The pathways provide opportunities for professionals to update their competences in response to technological developments while remaining consistent with the broader objectives of the Finnish vocational education system.

Rather than replacing existing qualifications, the pathways are intended to support continuing professional development and lifelong learning by providing targeted and flexible upskilling opportunities.

Spain

In Spain, the learning pathways respond to skills needs identified through stakeholder consultations and labour market analysis, particularly in areas related to electric vehicles, high-voltage systems and advanced vehicle technologies. The pathways complement existing vocational education and training provision and may contribute to future developments within the national qualifications ecosystem as demand for specialised competences continues to grow.

The modular nature of the pathways also provides opportunities for future alignment with competence-based approaches to training and certification.

Portugal

The Portuguese learning pathways were developed outside the formal National Qualifications Catalogue (Catálogo Nacional de Qualificações – CNQ). Nevertheless, their structure, learning outcomes and competence focus demonstrate significant potential for future alignment with existing qualification units and continuing training provision within the Portuguese qualifications system.

In particular, the pathways addressing high-voltage technologies and electric vehicle maintenance correspond closely to emerging skills needs identified by employers and sector stakeholders. As the transition towards electric mobility accelerates, these pathways may provide valuable inputs for future updates to qualifications, modular training provision or continuing professional development programmes within the automotive sector.

Across all three countries, the learning pathways demonstrate how flexible and targeted training provision can complement existing qualification systems while responding more rapidly to emerging technological developments and labour market needs

6.2. Stackability of Learning Pathways

A key principle underpinning the learning pathways developed under AutoCredify is stackability. Rather than requiring learners to undertake lengthy training programmes, competences can be acquired progressively through smaller learning units that build upon one another and contribute to broader learning outcomes.

The learning pathways were designed as structured combinations of shorter training modules addressing specific competence areas. This approach allows learners to access training according to their professional needs, previous experience and career objectives while supporting continuous competence development over time.

The stackability model adopted within AutoCredify can be conceptualised as follows:

Training Modules/Courses → Learning Pathways → Microcredentials → Occupational Progression

This model offers several advantages. First, it increases flexibility by allowing learners to engage with training opportunities without committing immediately to longer programmes. Second, it supports lifelong learning by

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

facilitating incremental competence development. Third, it creates opportunities for recognising and documenting learning achievements at different stages of professional development.

The progression observed across the national learning pathways reflects this principle. Foundation-level competences support access to more specialised training, while advanced pathways build upon previously acquired knowledge and skills. As a result, learners can progressively develop the competences required to move towards increasingly specialised occupational roles associated with the twin transition.

6.3. Learning Pathways as Building Blocks for Microcredentials

The learning pathways developed within AutoCredify exhibit several characteristics commonly associated with microcredential-based learning approaches. Although the pathways themselves do not currently constitute formal microcredentials, they provide a strong foundation for future microcredential development within the automotive maintenance and repair sector.

One of the most important characteristics is the clear definition of learning objectives and competence areas. Each pathway was designed to address specific occupational needs identified through the project's skills anticipation activities and stakeholder consultations. As a result, the learning outcomes are directly linked to labour market requirements and emerging technological developments.

The pathways also demonstrate a high degree of modularity. Individual training units can be delivered independently while simultaneously contributing to broader learning pathways and occupational development objectives. This modular structure is particularly well suited to microcredential implementation, as it enables learning achievements to be recognised and accumulated over time.

Another important characteristic is the presence of mechanisms supporting the recognition and validation of competences. Several pathways incorporate prior-learning validation, competence assessment and certification procedures that allow previously acquired knowledge and skills to be recognised and built upon. The Portuguese High-Voltage Technician pathway provides a particularly relevant example, combining prior-learning validation with theoretical and practical assessment linked to recognised industry standards. Similar approaches can also be observed in the Finnish pathways, where previous experience and competences may support progression within the learning pathway structure.

These features are closely aligned with the principles underpinning microcredentials, which seek to provide flexible, targeted and learner-centred opportunities for competence development. By enabling learning achievements to be recognised independently and progressively combined into broader competence profiles, the pathways support lifelong learning and facilitate adaptation to rapidly evolving labour market requirements.

Table 4 summarises the characteristics of the learning pathways that support future microcredential development.

Table 4 - Learning pathway characteristics supporting microcredential development

Characteristic	Evidence within AutoCredify Learning Pathways
Clearly defined learning outcomes	Learning objectives identified for all pathways
Labour-market relevance	Derived from WP2 and WP3 evidence and stakeholder consultations

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Characteristic	Evidence within AutoCredify Learning Pathways
Modularity	Pathways composed of shorter training units and modules
Recognition and validation of competences	Several pathways incorporate prior-learning validation, competence assessment or certification mechanisms supporting recognition of acquired skills
Progressive structure	Supports incremental competence development
Stackability	Enables accumulation of learning achievements over time
Occupational relevance	Aligned with identified occupational development needs

While the pilot countries differ in terms of the maturity of their microcredential ecosystems and the extent to which microcredentials are integrated within national education and training systems, the learning pathways developed through AutoCredify demonstrate significant potential to support future microcredential initiatives. Their modular structure, occupational relevance, progressive design and mechanisms for recognising and validating competences provide a solid basis for the development of flexible learning opportunities capable of supporting workforce upskilling and reskilling within the European automotive maintenance and repair sector.

6.4. Cross-Country Transferability and European Added Value

Although developed within different national contexts, the learning pathways demonstrate a high degree of convergence regarding both competence priorities and occupational development needs.

Across Finland, Spain and Portugal, stakeholders consistently identified electric vehicle technologies, high-voltage systems, battery technologies and advanced diagnostics as priority areas for workforce development. This convergence suggests that many of the skills challenges associated with the twin transition are shared across national boundaries.

The use of the Automotive Skills Alliance occupational profiles as common reference frameworks further strengthens the transferability potential of the learning pathways. The Electric Vehicle Technician (EVT) and Automotive Mechatronics Specialist (AMS) profiles provide a shared European language for describing competence requirements and occupational development trajectories.

This common framework facilitates comparison between national learning pathways and supports the identification of shared competence areas across countries. It also creates opportunities for future cooperation in the development, recognition and potential portability of learning achievements within the European automotive ecosystem.

The combination of nationally relevant learning pathways and European occupational reference profiles therefore represents a significant added value of the AutoCredify approach. It enables local labour market needs to be addressed while simultaneously supporting broader European objectives related to skills development, workforce mobility and lifelong learning.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

6.5. Key Findings for Future Microcredential Development

The analysis presented throughout this report demonstrates that the learning pathways developed under AutoCredify provide a strong foundation for future microcredential development within the automotive maintenance and repair sector.

Several key findings emerge from the analysis:

First, the three pilot countries show a remarkable degree of convergence regarding the skills priorities associated with the twin transition. Electrification, high-voltage systems, battery technologies and advanced diagnostics consistently emerged as areas requiring targeted upskilling and reskilling interventions.

Second, the learning pathways demonstrate a clear progression logic that supports occupational development and lifelong learning. The pathways enable learners to move from foundational competences towards increasingly specialised technical capabilities, reflecting the evolving requirements of the automotive sector.

Third, the pathways exhibit many of the characteristics associated with effective microcredential provision, including modularity, labour-market relevance, stackability and clearly defined competence areas.

Finally, the use of common European occupational reference profiles provides an important basis for future cooperation, comparability and transferability across national contexts.

Taken together, these findings suggest that the learning pathways developed within AutoCredify can serve not only as immediate training responses to emerging skills needs, but also as potential building blocks for future microcredential ecosystems capable of supporting workforce development throughout the European automotive maintenance and repair sector

7. Conclusions and Recommendations

The previous chapters presented the evidence base underpinning the learning pathways developed within AutoCredify, analysed their relationship with occupational development needs and explored their potential contribution to future microcredential initiatives. Together, these findings provide a comprehensive picture of how the automotive maintenance and repair sector is responding to the skills challenges associated with the twin transition.

As the project moves towards the pilot implementation phase, it is important to consolidate the key lessons emerging from the analysis and identify the implications for the testing and validation of the proposed learning pathways. This chapter therefore summarises the main findings of the report and presents a set of recommendations intended to support pilot implementation, facilitate evidence gathering and inform future developments related to stackable learning pathways and microcredentials.

7.1. Key Findings

The analysis conducted within AutoCredify demonstrates that the automotive maintenance and repair sector is undergoing a profound transformation driven by the twin transition. Across the three pilot countries, stakeholders consistently identified vehicle electrification, high-voltage systems, battery technologies and advanced diagnostics as priority areas requiring targeted upskilling and reskilling interventions.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Despite differences in national training systems, qualification structures and labour market contexts, the evidence gathered through the country reports revealed a remarkable degree of convergence regarding both current skills gaps and anticipated future competence needs. This convergence provided a strong foundation for the identification of common occupational development trends and the design of learning pathways capable of addressing emerging workforce requirements.

The selection of the Automotive Skills Alliance occupational profiles Electric Vehicle Technician (EVT) and Automotive Mechatronics Specialist (AMS) proved highly relevant in this context. The analysis showed that the competences associated with these profiles reflect many of the occupational developments currently taking place across the automotive maintenance and repair sector. While the EVT profile emerged as the occupational profile most directly aligned with stakeholder priorities, the AMS profile also provides an important reference framework for the growing integration of electrical, electronic and digital technologies within modern vehicles.

The learning pathways developed by the project partners represent practical responses to these identified skills needs. Although differing in structure, duration and implementation approaches, the pathways share a common progression logic, supporting learners in moving from foundational competences towards increasing levels of specialisation in electric vehicle technologies and high-voltage systems.

The analysis also demonstrated that the pathways possess several characteristics associated with future microcredential provision, including modularity, labour-market relevance, stackability and mechanisms supporting the recognition and validation of competences. These characteristics provide a strong foundation for future developments in flexible and learner-centred training provision within the automotive maintenance and repair sector.

7.2. Implications for Pilot Implementation

The findings presented in this report have direct implications for the design and implementation of the pilot activities foreseen within AutoCredify.

First, the evidence confirms that pilot activities should focus on competence areas directly associated with vehicle electrification and high-voltage technologies. These themes emerged consistently across all pilot countries and represent the areas where stakeholders identified the most pressing workforce development needs.

Second, the analysis highlights the value of using common occupational reference frameworks while maintaining flexibility in national implementation approaches. The selected ASA occupational profiles provide a shared European reference point that can support consistency, comparability and transferability across pilot activities while allowing partners to adapt training provision to local labour market conditions.

Third, the learning pathways demonstrate the feasibility of modular and progressive approaches to competence development. Pilot implementation therefore provides an opportunity to test how learners progress through different learning stages, how competences can be accumulated over time and how flexible learning approaches can support workforce upskilling and reskilling.

Finally, the pilot phase represents an important opportunity to generate evidence regarding the practical implementation of stackable learning pathways and their potential future transformation into microcredentials. The experience gained through pilot implementation will therefore be critical in informing subsequent project activities and future sectoral initiatives.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

7.3. Recommendations for Pilot Design and Implementation

The analysis presented in this report provides the evidence base for the design and implementation of the AutoCredify pilot activities. Building upon the occupational pathways, learning pathways and competence priorities identified in the previous chapters, the following recommendations outline the key design principles that should guide the implementation and validation of the pilot microcredentials. Together, they aim to ensure that the pilots generate robust evidence to support future adoption, scalability and recognition of microcredentials within the automotive maintenance and repair sector.

Governance

Effective governance should ensure that pilot implementation remains responsive to labour-market needs while enabling continuous improvement throughout the project.

The pilots should therefore:

- establish a lightweight multi-stakeholder steering mechanism involving training providers, employers and relevant sector representatives;
- embed employer validation throughout the pilot lifecycle, ensuring that industry contributes not only to the initial design of the learning pathways but also to the validation of learning outcomes and their relevance to workplace requirements.

Pedagogy

The pedagogical approach should reflect the practical nature of the automotive maintenance and repair sector and support the progressive acquisition of occupational competences.

Pilot implementation should therefore:

- adopt workflow-based blended learning approaches that combine digital learning with practical training in authentic or simulated working environments;
- ensure that digital delivery complements rather than replaces hands-on competence development;
- maintain the progressive and stackable structure of the learning pathways developed within the project.

Assessment

Assessment should demonstrate that learners are capable of applying the acquired competences within realistic occupational contexts.

The pilots should therefore:

- prioritise authentic assessment methods based on practical demonstration of competences;
- establish common assessment principles that ensure consistency across the pilots while allowing sufficient flexibility to accommodate different national implementation contexts;
- collect evidence regarding the effectiveness and feasibility of different assessment approaches to support future microcredential development.

Quality Assurance

Quality assurance should support both the credibility of the pilot activities and the future recognition of the proposed microcredentials.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

The pilots should therefore:

- recognise trainer and assessor competence as a fundamental quality assurance requirement;
- involve employers and sector representatives in validating learning outcomes and assessment processes;
- monitor learner progression, assessment outcomes and stakeholder feedback in order to generate evidence for continuous improvement and future impact evaluation.

Financial Sustainability

Long-term adoption of the proposed learning pathways and future microcredentials will depend on their ability to create value for both learners and employers.

The pilot activities should therefore:

- make the business case for employer participation explicit by demonstrating how competence development contributes to workforce capability, organisational resilience and competitiveness;
- collect evidence on the perceived benefits, costs and organisational impact of the proposed learning solutions to inform future scaling and sustainability strategies.

7.4. Final Remarks

The work undertaken within AutoCredify demonstrates that, despite differences in national systems, institutional arrangements and training traditions, the pilot countries face remarkably similar challenges associated with the twin transition in the automotive maintenance and repair sector.

The occupational pathways and learning pathways developed through the project provide structured and evidence-based responses to these challenges, supporting the development of competences that are increasingly critical for the future workforce. At the same time, their modular and progressive design creates favourable conditions for the implementation of stackable learning approaches and future microcredential developments.

Beyond identifying priority skills areas and training needs, the work presented in this report establishes a practical foundation for the implementation of the project pilots. The pilot activities will play a critical role in validating the relevance, effectiveness and transferability of the identified pathways, while generating evidence to support future developments in microcredentials, lifelong learning and workforce development within the European automotive maintenance and repair sector.

By combining labour-market intelligence, stakeholder engagement, European occupational reference profiles and nationally relevant learning pathways, AutoCredify contributes to a more flexible, responsive and future-oriented approach to skills development capable of supporting both workers and employers in navigating the challenges of the twin transition

8. References

AutoCredify (2025). *D3.4 Country Reports: Finland, Spain and Portugal*. AutoCredify Project, Work Package 3. Unpublished project deliverable.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

Automotive Skills Alliance (ASA) Skills Hub (2025). *Occupational Profiles: Electric Vehicle Technician and Automotive Mechatronics Specialist*. Automotive Skills Alliance.

Skills Hub (2026). *Autocredify - National Learning Pathways Developed under Work Package 5.* https://skills-hub.eu/asa-learning-paths

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union

List of Annexes

Annex A – Electric Vehicle Technician (Skills Card)

Annex B – Automotive Mechatronics Specialist (Skills Card)

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union