DRIVES

Development and Research on Innovative Vocational Education Skills

PRELIMINARY STRATEGIC ANALYSIS

Deliverable 2.9.1 Automotive Skills strategic Roadmap

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1 EXECUTIVE SUMMARY

DRIVES is a four-year project created to deliver human capital solutions to the automotive supply chain and SMEs. The project involves the establishment of an Automotive Sector Skills Alliance, covering all levels of the value chain (vehicle production, supply, sales, aftermarket services and disposal), including an EU-wide network of partners disseminating information to more than 300 associations and 270.450 companies of all sizes, representing over 7 million workers.

DRIVES goals can be summarised under the following:

1. Roadmap for Skills: Identify skills needs in the sector and create a pool of 60 described job roles.
2. Skills Framework: Map and assess existing and proven Skills Frameworks in European countries; improve the framework to match the needs in the automotive sector in the coming decade.
3. Skills' Umbrella: Implement a new common European automotive skills umbrella through the integration of existing skills frameworks (Sector skills council, ECQA, AQUA, SkillMan, Skills Passport, etc.)
4. Training and Recognition across the EU with respect to new job roles: Enable EU-wide mutual recognition of awards and certificates between formal and informal automotive education, VET and universities.
5. Job creation: Provide an effective EU-wide apprenticeship marketplace for automotive job seekers. Create an IT infrastructure to facilitate the dissemination of common job requirements. Promote the portal as a labour market tool at national and European levels.

In a world that is evolving more rapidly towards new technologies and where the security and use of Big Data are becoming an essential element in the development of commercial strategies, the automotive sector is going to experience a new epochal change, perhaps greater than what was experienced in the early 20th century, with industrial automation in U.S. factories. Given this, it is necessary to anticipate the R&D needs and associated changes in skills and competences that training institutes in Europe will need to teach to (young) people who want to develop a career path within the automotive sector.

This preliminary report has been created to summarise Work Package 2 activities during the first year of the project, including the initial strategy adopted to develop the WP2 questionnaire utilised to engage stakeholders. In chapter one, APPROACH TO THE WORK PACKAGE, an holistic analysis of the tasks and time frameworks relating to WP2 activities is explained and a programme of desk-based analysis is introduced (Requested specifically by the Commission). The opportunity to compare the above information with an ad-hoc partnership created with LinkedIn has also been evaluated as an

important new strategy. In chapter two, THE STRATEGIC PROCESS, all the activities necessary to create the approach to the project are summarised. 8 main areas are investigated and mapped which form the structure of the questionnaire:

- Representation of the sector
- Stakeholders
- Drivers of Change
- Target occupations
- Target Skills
- VET provision mechanisms
- Skill recognition and qualification frameworks
- Recruitment and attractiveness of the sector

Chapter 3, the VISION OF THE SECTOR, has been developed through desk-based research analysis using existing studies of the Automotive sector, together with information derived directly from DRIVES partners. The main outcome of this work can be summarised with the PricewaterhouseCoopers' acronym that describes the vision for sector – **EASCY** - to indicate a vehicle Electrified, Autonomous, Shared, Connected and "Yearly" updated.

The automobile and parts sector in Europe is responsible for 27% of the region's total R&D spending and over 8,700 automotive patents were granted by the European Patent Office in 2017. 13.3 million people (6.1% of the EU employed population) work directly and indirectly in the sector and 3.4 million jobs in automotive manufacturing representing over 11% of total EU manufacturing employment. Motor vehicles account for some €413 billion in tax contributions in the EU15 alone.The automobile industry exported 5.9 million motor vehicles in 2017, generating a trade surplus of €90.3 billion for the EU.

A summary of the desk-based research linked to the vision of the sector is set out in Chapter 4. The integration of these two strands of work provides the foundation (**BASE**) for the first year of the WP2 project. Results of this work are summarised as:

- **B**: Big Data
- **A**: ADAS and After sales
- **S**: Supply chain and Sharing
- **E**: Electrification

These elements will impact directly and/or indirectly on the sector, most of them as Drivers of Change and others as core aspects of this change themselves. The **BASE** scenario will be integrated with views of stakeholders of the vision of the sector, as the basis for the DRIVES strategy roadmap.

The **BASE** scenario provides one forecast of number of jobs created set against the number of jobs lost: a study from the European Association of electrical contractors (AIE) has assessed job creation in a number of sub-sections of the electromobility production process and concludes that by 2030 a total of nearly 200,000 permanent jobs will be created. This is based on a moderate uptake of plug-in vehicles amounting to around 35% of new car sales by 2030. Of these 200,000 jobs, 57% will come from the installation, operation and maintenance of charging points. It then compares this with a study by Germany's Fraunhofer research institute into the impact of electrification on jobs. Based on this research an estimated total of 306,000 jobs in the automotive manufacturing sector will be lost by 2030, but only 27% of these (so around 84,000) are specifically due to an increase in electromobility, the rest are the result of productivity improvements.

Although exact numbers of job losses and gains are difficult to assess there is general agreement in the reviewed literature that there will be a demand for new skills and competences and the emergence of new occupations not existing today. In order to analyse the demand for new skills and capture the views of those involved in the sector, WP2 decided to engage stakeholders directly using a survey strategy. This is described in detail in the chapter THE QUESTIONNAIRE.

The survey is the tool that DRIVES partners have used to gather information from stakeholders. With the agreement of DRIVES partners, it was designed as an online self-completion survey, using a combination of closed and open-ended questions. The preliminary report has different ANNEXES with detailed information on:

- EUROSTAT ANALYSIS OF THE SECTOR
- REPORTS AND DOCUMENTS USED TO MAP DRIVERS OF CHANGE AND SKILLS
- WP2 OCCUPATION MAPPED

2 APPROACH TO THE WORK PACKAGE

The "SECTORAL INTELLIGENCE AND STRATEGY" Work Package has the objective to bringing together updated information from partners and governing body members, and, together with market information will:

- Ensure a **constant view on the changing skills needs in the automotive sector**, linked to the main drivers (emerging technologies and trends) that are influencing this change
- Allow aggregation and continuous updating of sectoral knowledge and intelligence at a European level
- Enable definition and continuous updating of a strategic roadmap for skills in the automotive sector, relying on the existing GEAR2030 strategy[1]
- **Provide advice to WP3, WP4 and WP5** to ensure future skills needs are being taken into consideration by those WPs.
- Enable **development of a common methodology for assessing the current situation and anticipating future needs,** as well as monitoring (on a yearly basis) progress and the evolution of the demand and supply of skills, based on credible foresight scenarios

The "SECTORAL INTELLIGENCE AND STRATEGY" Work Package is active throughout the whole DRIVES project period and comprises five tasks:

Task 2.1: Stakeholders: Identification of the most relevant stakeholders to be involved in the activity at EU level and creation and consolidation of an EU-wide DataBase. Lead by SPIN 360, PARTNERS INVOLVED: ACEA, CLEPA, TU GRAZ, SEMTA, AIC, VSB TU, ETRMA, ISCN, EFVET, SFC.

Aims at aggregating in a single source all the most important stakeholders at European level. Stakeholders that will be sought for and involved in WP activities included: SMEs, Large Enterprises, Chambers of Commerce, Industrial Associations, Trade Unions, labour ministries, training and education providers, labour market intelligence entities, public and private employment services, national statistics offices. Main outcome of the Task will be a stakeholder Database, updated and accessible (according to EU GDPR) by all project partners.

Task 2.2: Occupational Profiles: Identification and characterisation of the occupational profiles to be investigated. Lead by SEMTA. PARTNERS INVOLVED: ACEA, CLEPA, TU GRAZ, SEMTA, VSB TU, ETRMA, SPIN 360, EFVET, SFC.

[1] *https://clepa.eu/mediaroom/gear-2030-final-report-european-automotive-competitiveness-2030/*

The main steps for this task are:

- Detailed analysis of the outcomes of the Automotive Skills Council and comparison with ESCO requirements of Occupational profiles
- Selection of the occupational profiles on which the project should focus
- Characterisation of the occupational profiles, conforming with the ESCO format
- Precise identification of the skills required for the occupations characterised
- Validation of the occupational profiles and associated skills needs through active involvement of the relevant stakeholders

Task 2.3: Sectoral Intelligence: Qualitative and quantitative forecasting. The aim of Task 2.3 is to work with national organisations across Europe to extract technology roadmaps and pieces from industry leaders identifying trends and to provide a timeline relating to insights and likely impact dates.
Lead by SPIN360, PARTNERS INVOLVED: ACEA, CLEPA, TU GRAZ, SEMTA, AIC, VSB TU, ETRMA, ISCN, EFVET, SFC.

The main steps for this task are to:

- Analyse in detail the background knowledge on the evolution of the sector (strategic roadmaps, Skills council report[2] and GEAR 2030…),
- Carry out an extended survey among different categories of market actors in order to analyse the real market potential of identified occupations,
- Provide evidence of the related sector skills needs in an electronic form,
- Share the data elaborated with WP 3, 4, 5.

Task 2.4: Skills Needs: The aim of this task is to analyse the VET and training offer at European Level and identify the training GAPs and need of the occupations identified and characterised in Task 2.2. Lead by SPIN360, PARTNERS INVOLVED: ACEA, CLEPA, SEMTA, SPIN 360, ETRMA, SFC.

All the relevant key stakeholders will be contacted through the on-line survey. An important outcome of this WP will also be to identify both potential changes in existing VET Curricula and potential training programmes to be implemented in the future. This will inform work being undertaken in WPs' 3, 4, 5.

Task 2.5: Intelligence Update and Roadmap Definition: The main objectives are to:

- Provide an holistic analysis of the current situation using existing documents and research in order to create a preliminary picture of current skills needs and gaps Actively discuss and disseminate the project outcomes, involving key sector stakeholders and also to prepare the ground for future training activities and projects

2 *European Sector Skill Council: Report, Eu Skill Council Automotive Industry, 2013*

- Aggregate and continuously update sectoral knowledge and intelligence at European level
- Define and continuously update a strategic roadmap for skills in the automotive sector, building on the existing GEAR2030 strategy
- Ensure an online resource is maintained for the project duration providing information that can be used by key sectoral stakeholders

Lead by SPIN 360, PARTNERS INVOLVED: ACEA, CLEPA, SEMTA, AIC, ETRMA, SFC.

During the Task, the following categories of stakeholder will be continuously updated: labour ministries, national social partners, labour market intelligence entities, companies including SME's, chambers of commerce, public and private employment services, VET providers. All the information collected will be continuously updated and the outputs will inform the project web site. Releases of structured documents are foreseen at month 24, 36, 48. The SECTORAL INTELLIGENCE AND STRATEGY METHODOLOGY is summarised in Figure 1:

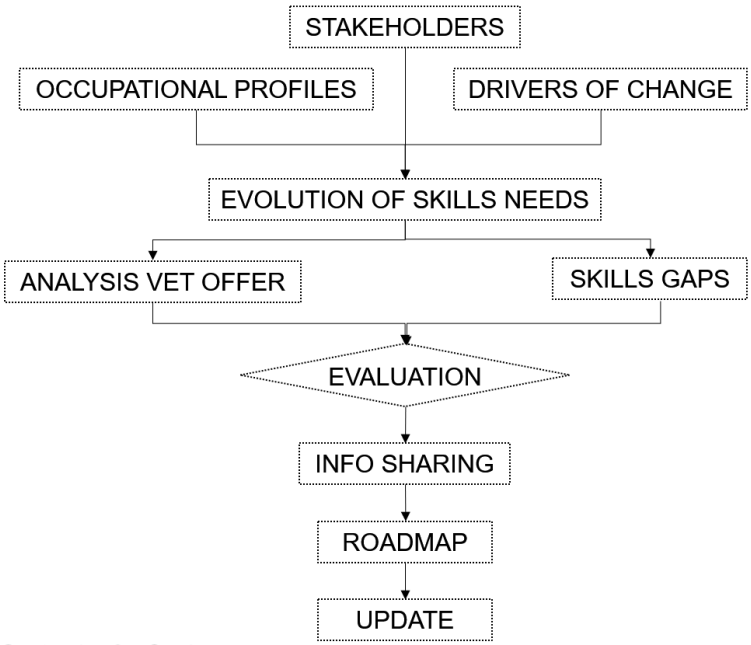

Figure 1: Original WP2 process structure.

After the initial kick-off project meeting an extra activity was required by the Commission: a desk-based analysis of currently available automotive literature in order to develop a structured introductory framework for the remainder of the WP.

The preliminary strategy report is therefore an extra activity not originally planned in relation to the Work Package. This activity allows partners to understand the relevant research and information already available and has also underpinned development of the demand focussed WP2 questionnaire.

The approach has enabled development of the questionnaire without prior involvement of wider stakeholders, thus ensuring stakeholder responses are not influenced by involvement in questionnaire design. During the first year of the project, DRIVES also held discussions with LinkedIn[3], a well-known international professional social network. As a result of these discussions a partnership with the DRIVES project has been established. This partnership provides the potential to utilise Big Data held by LinkedIn in order to consolidate information already collected by the Project. The outcomes of the desk-based research, together with Big Data extracted via LinkedIn queries will be compared with responses to the DRIVES questionnaire in order to develop a structured vision of the sector and support the first release of the strategic roadmap for the project. A summary of the WP2 methodology is shown in Figure 2.

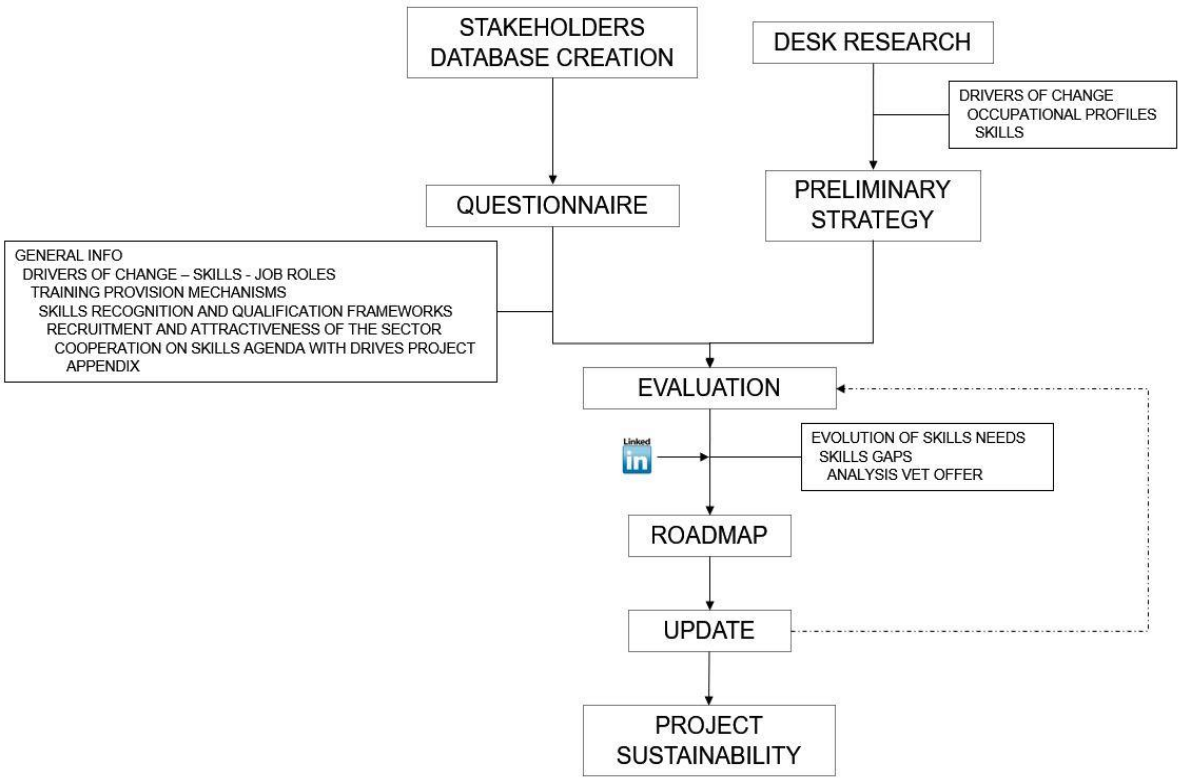

Figure 2: Operative structure of WP2 with introduction of the preliminary desk research analysis task.

3 www.linkedin.com

1) To map the Drivers of Change and Skills presented into the GEAR2030 and Automotive Skills council reports. The map is comprising a matrix where the first column is the title of the report and all the other columns are Drivers of Change and Skills labels).

2) To identify with partner's support the different literature and reports available to be analysed (see Annex "REPORTS AND DOCUMENTS USED TO MAP DRIVERS OF CHANGE AND SKILLS").

3) To map reports and documents highlighting the relative frequency each specific Driver of Change is cited in the wider literature review (the percentage has been calculated using the previous descripted methodology where the presence of a Driver of Change in a report has been indicated with a „+1" value to this specific Driver of Change and compared with the sum of the presence of all the Drivers of Change)

3 THE STRATEGIC PROCESS

As a result of the strategy design process desk-based analysis and partner input, 8 strategic areas were identified as the basis for defining the areas of investigation to focus the questionnaire. These were:

- Representation of the sector
- Stakeholders
- Drivers of Change
- Target occupations
- Target Skills
- VET provision mechanisms
- Skill recognition and qualification frameworks
- Recruitment and attractiveness of the sector

3.1 REPRESENTATION OF THE SECTOR

Accurate representation of the sector is important in order to ensure an appropriate framework for investigating and classifying stakeholders and harmonising the questionnaire outcomes.

The frameworks and classifications utilised were:

- The NACE[4] rev. 2 codes
- Classification of the supply chain structure of the sector
- Classification of the value chain structure of the companies and organisations interviewed
- The ESCO[5] group classification
- Elaboration of Eurostat[6] statistics

The DRIVES partners agreed to define the scope of the automotive sector for the purposes of the DRIVES Project, based on the following NACE codes:

C29.1 - Manufacture of motor vehicles

C29.2 - Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers

C29.3 - Manufacture of parts and accessories for motor vehicles

C22.1.1 - Manufacture of rubber tyres and tubes; re-treading and rebuilding of rubber tyres

4 https://ec.europa.eu/eurostat/web/nace-rev2/overview

5 https://ec.europa.eu/esco/portal

6 https://ec.europa.eu/eurostat/data/database

G45.1 - Sale of motor vehicles

G45.2 - Maintenance and repair of motor vehicles

G45.3 - Sale of motor vehicle parts and accessories

Based on the above, the "scope of the Project" can be summarized by Figure 3 where the NACE codes are linked with a definition of the supply chain structure defined by the project; Eurostat indicators will be aggregated based on this.

RAW MATERIALS		
SUPPLIER	C29.2	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
	C22.1.1	Manufacture of rubber tyres and tubes; re-treading and rebuilding of rubber tyres
	C29.3	Manufacture of parts and accessories for motor vehicles
MANUFACTURER	C29.1	Manufacture of motor vehicles
SALES	G45.1	Sale of motor vehicles
	G45.3	Sale of motor vehicle parts and accessories
AFTERMARKET	G45.2	Maintenance and repair of motor vehicles

Figure 3: Aggregation of NACE codes per Automotive supply chain steps

DRIVES partners highlighted the need to take into consideration both the current internal organisation of automotive companies and evidence of specific areas of new and emerging skills demand. Taking this into consideration, Consortium Partners proposed the use of the Michael Porter definition of the value chain[7] as set out in Figure 4. This approach was selected given the widespread academic and industry acceptance internationally of this representation of the supply chain.

7 *Michael Porter, Competitive Advantage: Creating and Sustaining Superior Performance, 1985*

Figure 4: A value chain is a set of activities that a firm operating in a specific industry performs in order to deliver a valuable product or service for the market.

A value chain is a set of activities that a firm operating in a specific industry performs in order to deliver a valuable product or service for the market. The value system of a company is divided into 2 main activities and several value chains steps:

PRIMARY ACTIVITIES

- Inbound logistics: arranging the inbound movement of materials, parts, and/or finished inventory from suppliers to manufacturing or assembly plants, warehouses, or retail stores.
- Production: concerned with managing the process that converts inputs (in the forms of raw materials, labour, and energy) into outputs (in the form of goods and/or services).
- Outbound logistics: is the process related to the storage and movement of the final product and the related information flows from the end of the production line to the end user.
- Marketing and sales: selling a product or service and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large.
- Service: includes all the activities required to keep the product/service working effectively for the buyer after it is sold and delivered.

SUPPORT ACTIVITIES

- Organisational structure: consists of activities such as accounting, legal, finance, control, public relations, quality assurance and general (strategic) management.
- Research and Development: pertains to the equipment, hardware, software, procedures and technical knowledge brought to bear in the firm's transformation of inputs into outputs.

- Personnel management: consists of all activities involved in recruiting, hiring, training, developing, compensating and (if necessary) dismissing or laying off personnel.
- Procurement: the acquisition of goods, services or works from an outside external source

The value chain structure is included in the survey, in order to identify the areas in which the identified Occupations/Job roles will impact in terms of skills change. It will also be used as a basis to map and normalise the results of the questionnaire.

ESCO

ESCO[8] is the multilingual classification of European Skills, Competences, Qualifications and Occupations and it is part of the Europe 2020 strategy. The ESCO classification identifies and categorises skills, competences, qualifications and occupations relevant for the EU labour market and education and training. It systematically shows the relationships between these different concepts. It has been agreed that WP2 outputs must conform to ESCO format with this classification together with the International Standard Classification of Occupations -ISCO[9]- used to structure occupations analysed as part of WP2 activities.This provides an accepted framework within which normalisation of questionnaire outcomes can take place and enable these outcomes to be related to wider secondary data sets.

Representation of the sector based on the most relevant Eurostat data is included in the Appendix. The questionnaire was not structured using ESCO categories, as the decision was made by partners to keep the survey as open as possible when capturing stakeholder views. Normalisation of survey results in order to conform with the ESCO classification has therefore been undertaken after survey responses have been captured. In order to verify the representativeness of stakeholders responding to the survey across different EU countries a simple question in the survey, asking respondents to declare the NACE code of their organisation was included.

The information on the representation of the sector will onlt be periodically updated if, during the analysis of survey results a significant divergence from the original representation defined by the partnership is identified.

8 *https://ec.europa.eu/esco/portal*

9 https://ec.europa.eu/esco/portal/occupation

3.2 STAKEHOLDERS

Structured engagement with stakeholders is critical for both WP2 and other WP activities, with the main challenge being the need to successfully capture often complex responses from stakeholders who are often severely constrained by time. Stakeholders have been identified and characterised in the early stages of the project in order to create an EU stakeholders' database that will serve the need to identify an appropriate sample for the WP2 survey, but also for the design and development of the network that will survive the project lifespan.

The EU stakeholders database that has been developed comprises:

- SMEs
- Large Enterprises
- Chambers of Commerce
- Industrial Associations
- Trade Unions
- labour ministries
- training and education providers
- labour market intelligence entities
- public and private employment services
- national statistics offices

The current[10] stakeholder's DataBase composition is represented in the Figure 5, 6 and 7:

10 *Update situation at January, 30th 2019*

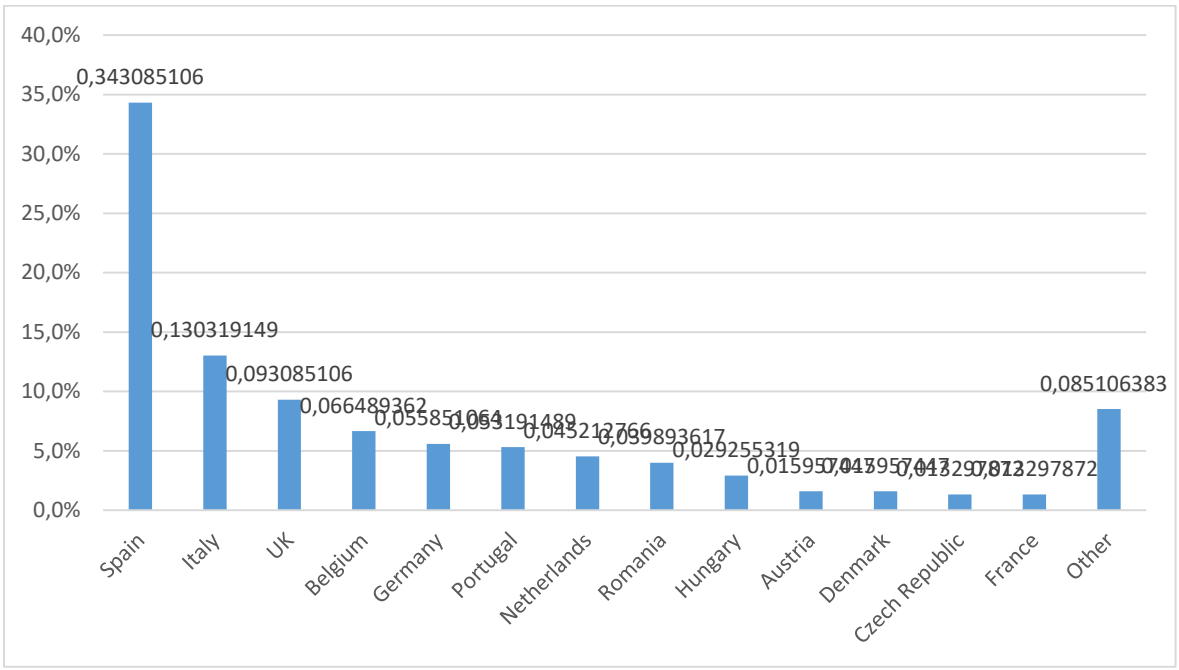

Figure 5: Composition of current stakeholders DataBase (%) by geographic distribution.

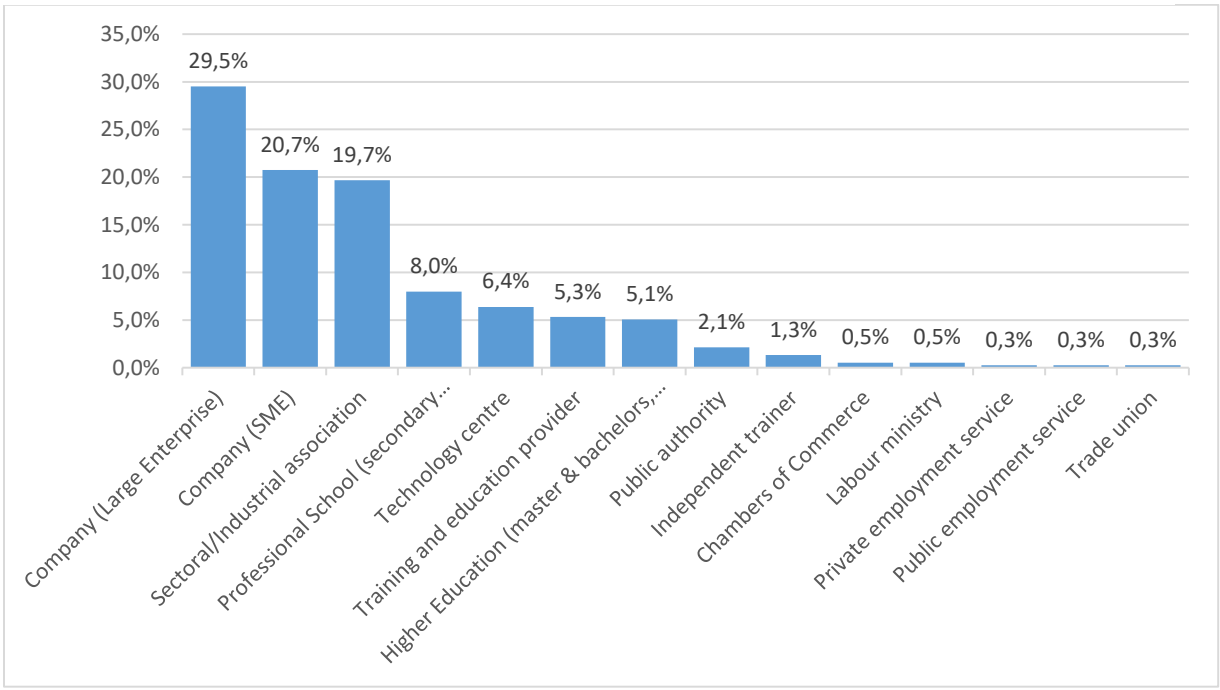

Figure 6: Composition of current stakeholders DataBase (%) by project's categories.

Analysis of the composition of the current EU stakeholder database indicates that representation varies widely, with a particular predominance of Spanish stakeholders. By contrast, when compared with ACEA data relating to income generated by the motor vehicle sector, Germany and particularly France are currently relatively under-represented.

Based on ACEA statistics[11] in relation to the <<Fiscal income from motor vehicles in the EU-15, by country>> the TOP 5 countries measured on this basis are:

1) Germany – €92 billion
2) France – €79 billion
3) Italy – €74.4 billion
4) United Kingdom – €56.3 billion
5) Spain – €28.1 billion

In terms of the composition of the database by different stakeholder categories, Company (SME and Large enterprise) and Industrial Associations represent about 70% of the Stakeholders DataBase. It will be essential for the DRIVES consortium to broaden the composition of the Stakeholders database in order to meet forthcoming project needs.

11 https://www.acea.be/statistics/article/interactive-map-fiscal-income-from-motor-vehicles-in-the-eu-15-by-country

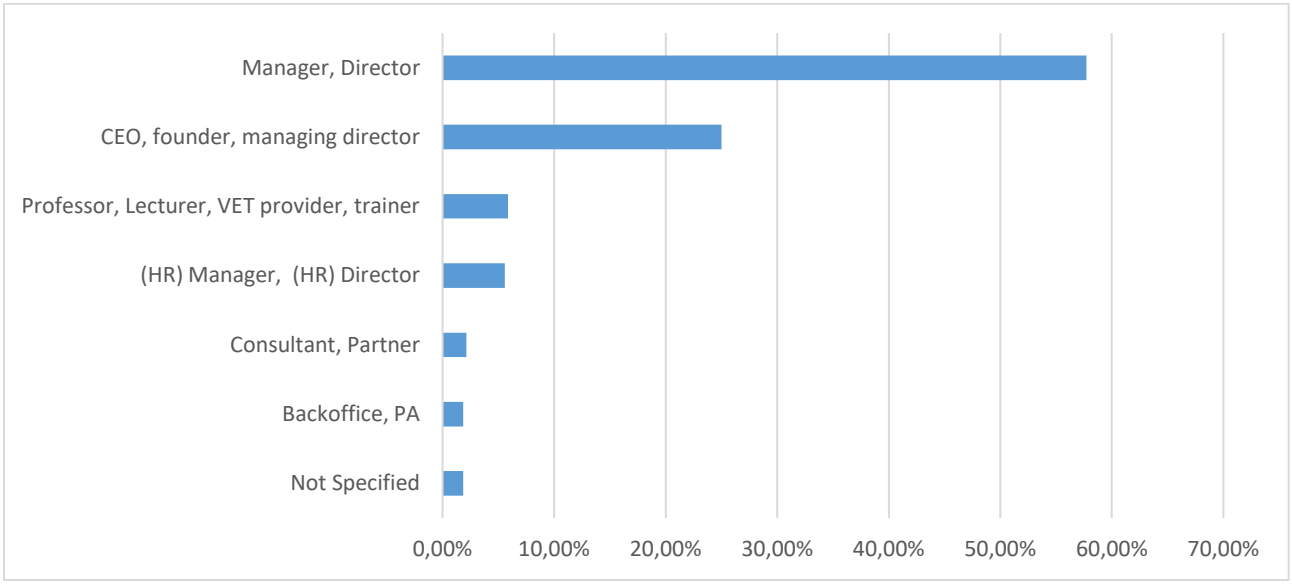

Figure 7: Composition of current stakeholders DataBase (%) by respondent's occupation.

In terms of the stakeholder composition by position, CEOs, Directors and Managers comprise 80% of the sample. Given the survey methodology, this is to be expected, with these groups the most likely to respond on behalf of each employer.

3.3 DRIVERS OF CHANGE

Drivers of change are those factors which are key to transforming an industry. Desk-based research was undertaken as the basis for this aspect of WP activities. Specifically, a literature review of available automotive reports was undertaken in order to create an overview of current Drivers of Change and their relevance. The analysis compares the outcomes of the European Automotive Skill Council[12] report and GEAR 2030 report[13], with other available intelligence/reports related to the EU automotive sector in order to identify the main Drivers of Change within the European automotive sector.

After identifying the key Drivers of Change using the European Automotive Skill Council report and GEAR 2030 report, the wider literature review was undertaken in order to validate, review and add new Drivers of Change to this initial list. Through this approach five main 'macro' Drivers of Change have been identified, these being:

- New technologies and business models

12 *European Sector Skill Council: Report, Eu Skill Council Automotive Industry, 2013*

13 *GEAR 2030, High Level Group on the Competitiveness and Sustainable Growth of the Automotive Industry in the European Union, 2017*

- Climate goals, environmental and health challenges
- Societal changes and changes in the way that consumers access, purchase and use cars
- Structural change
- Globalisation and the rise of new players

Each 'macro' Driver comprises several more specific Drivers of Change that were identified as relevant. Analysis also focussed on the identification of emerging Drivers of Change. The literature review enabled the mapping of each initial macro Driver of Change against wider research evidence, based on the number of times each Driver was cited in those reports included in the review. This analysis enabled validation of the initial choice of Drivers of Change. Figure 8 outlines these results.

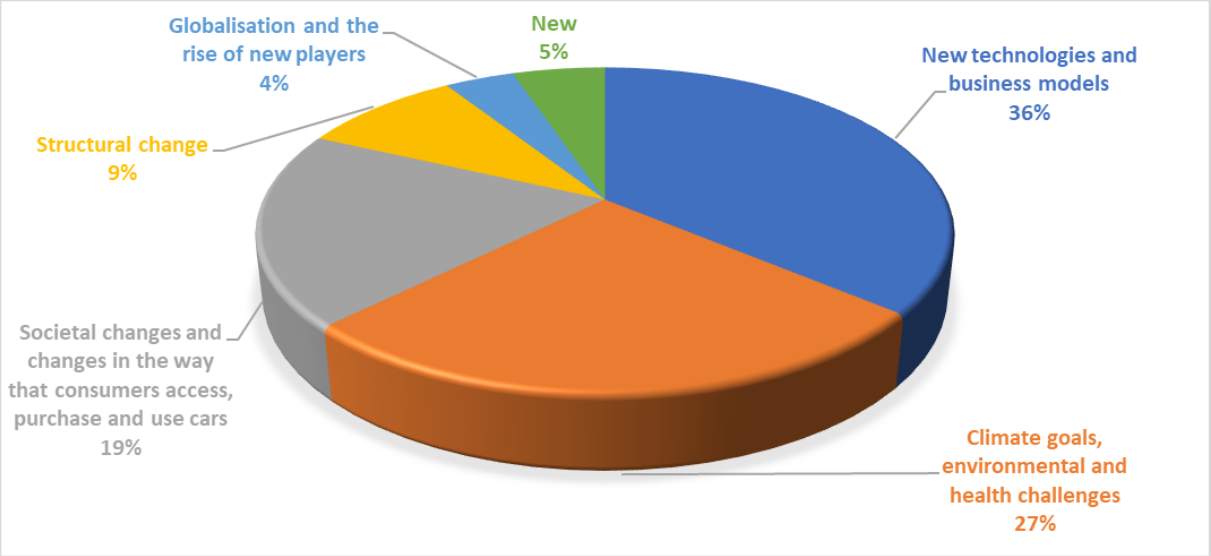

Figure 8: How much a Driver of Change is quoted related to all reports analysed.

Table 1 provides a more detailed analysis of the number of times each specific Driver of Change is cited in the reports reviewed as part of the study.

Each of the 5 macro Drivers comprises several more specific Drivers – 23 in total. This includes a few 'new' Drivers of Change not identified in the initial analysis based on the European Automotive Skill Council report and GEAR 2030 report. These have been incorporated into an "new" group (Cybersecurity, Access to raw materials, OEM products standardisation and Regulatory dialogue).

Based on the above approach, figures 9 to 14 present the results of analysis for each macro Driver, highlighting the relative frequency each specific Driver of Change is cited in the wider literature review (the percentage has been calculated using the previous descripted methodology where the presence of a Driver of Change in a report has been indicated with a „+1" value to this specific Driver of Change and compared with the sum of the presence of all the Drivers of Change).

It should be noted that some of the Drivers of Change are likely to overlap, or in some cases be directly dependent on one or more Drivers.

The reports used for the wider literature review were selected through an expert group, comprising automotive stakeholders of the DRIVES project. Selections was based on practical experience and usage of particular reports by stakeholders. This approach was supplemented with manual searches,

consultation with experts, further iterative improvements in searches using keywords from selected papers and further discussion to validate the final set of reports. The reports are, for the most part those representing the whole EU automotive industry and compiled by respected consultancy organisation or projects.

Table 1: Selected literature sources reflecting automotive sector

Reference	Name	Source	Year
a	Transforming vehicle production by 2030 – How shared mobility and automation will revolutionize the auto industry	PwC	2018
b	Ready for inspection – the automotive aftermarket in 2030	McKinsey	2018
c	Le competenze del futuro ripartono dalle persone e dai nuovi linguaggi	Il Sole 24ORE	2018
d	Employers' Views of the Jobs and Skills Required for the UK Automotive Industry	Automotive Council UK	2016
e	Making the future of mobility work	Deloitte	2017
f	Automotive revolution – perspective towards 2030	McKinsey	2016
g	Five trends transforming the Automotive Industry [10]	PwC	2017-2018
h	Forces of change: the future of mobility [11]	Deloitte	2017
i	Three surprising resource implications from the rise of electric vehicles [12]	McKinsey	2018
j	A road map to the future for the auto industry [13]	McKinsey	2014
k	Global Automotive Consumer Study - The changing nature of mobility, exploring consumer preferences in key markets around the world [14]	Deloitte	2014
l	The future of the Automotive Value Chain – 2025 and beyond [15]	Deloitte	2017
m	Accelerating toward 2020 – An automotive industry transformed [16]	Deloitte	2009
n	Lithium and cobalt: A tale of two commodities [17]	McKinsey	2018
o	Report, Eu Skill Council Automotive Industry, 2013	Eu skill council	2013
p	GEAR2030 (Automotive sector)	GEAR2030	2017

The New Drivers of Change are described in a new section, even if they could be included in one of the 5 main macro areas; each Drivers of Change title has a reference [letter[14]] with the specific reports / documents where it has been mentioned in the desk-research analysis cited.

14 *See Appendix*

3.3.1 NEW DRIVERS OF CHANGE

The desk-based research identified several new Drivers of Change, not identified in the Automotive Skill Council report but discussed in GEAR 2030 report or in the other literature sources.

- **OEM products standardisation and plug&play** [a][b][f]
  The car assembly process will be performed by robots with higher IA and the tendency will be to use ready-built and plug & play parts to make activities more efficient and faster; moreover OEMs will improve process and cost efficiency and might be able to set the standards in a market where brand attractiveness will diminish (due to the shift between car-owner to car-user). Common online platforms might connect supply and demand globally to increase the efficiency of players across the supply chain. This Driver of Change will be incorporated into the "New technologies and business models" group.
- **Access to raw materials** [i][l][n]
  In a disruptive scenario, activities linked to raw materials become critical, especially if some resources (limited in terms of quantity or geographical presence) are necessary to produce key components. From this point of view, the automotive sector will need to develop sourcing strategies to ensure a stable supply of critical and key raw material (eg. Lithium) to insulate them from the risk of shortages and potential price spikes. This Driver of Change will be incorporated into the "Globalisation and rise of new players" group.
- **Cybersecurity** [b][j]
  There will also be an impact from evolving legal requirements, consumer demands and acceptance of new technologies. This Driver of Change will be incorporated into the "Societal changes and change in the way that consumer access, purchase and use cars" group.
- **Global regulatory dialogue** [p]
  The EU Single Market is a key element for the maintenance of EU competitiveness. Future advantages are likely to be linked to increased standardisation between member states. It is evident that such process cannot be put in place by social partners or industry alone; the Commission and in general, Governments and public administrations will need to play a fundamental role in the elaboration of policies and strategies, from which the Automotive sector could benefit. This Driver of Change will be incorporated into the "Globalisation and rise of new players" group.

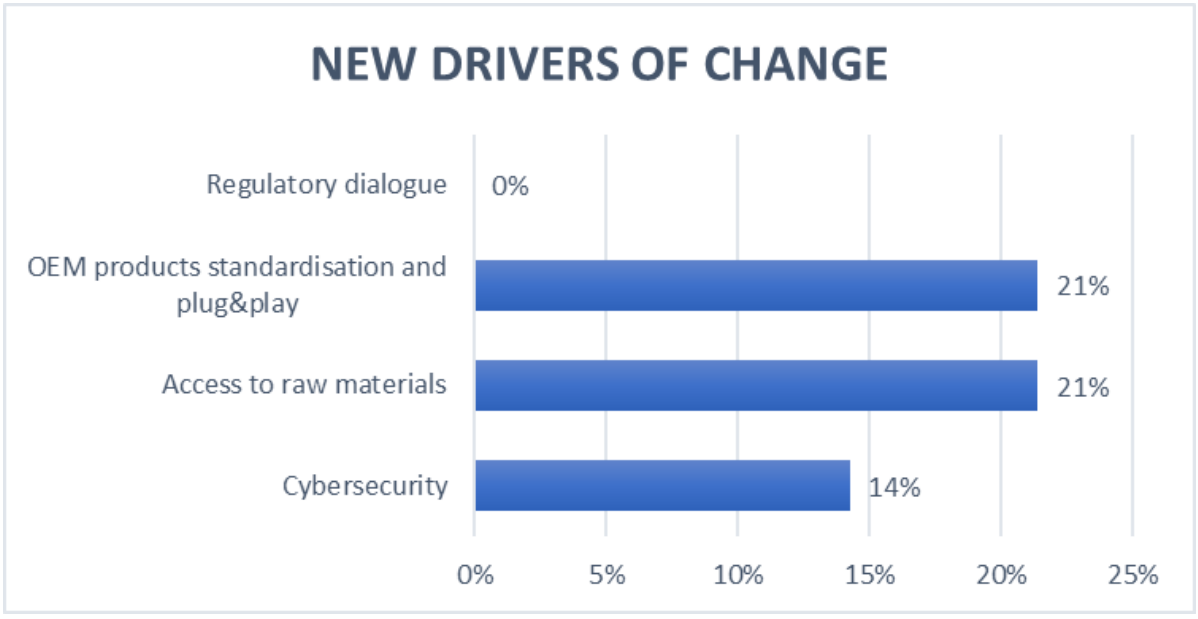

Figure 9: "New Drivers of Change" presence in available literature (%).

Figure 9 identifies the number of times each of these 'new' Drivers of Change is mentioned in the literature review undertaken. The Figure indicates:

- Regulatory dialogue is recorded as 0% as it is only mentioned in the Gear 2030 Report rather than the wider literature review.
- Both OEM products standardisation and plug &play and access to raw materials are recorded as 21% based on frequency of occurrence in the wider literature review
- Cybersecurity is recorded as 14%

3.3.2 NEW TECHNOLOGIES AND BUSINESS MODELS

These developments will lead to changes in the production and capability of vehicles. They will require substantial funding and/or financial support. Public authorities will have a key role to play in facilitating the roll-out of automated driving and alternative powered trains by putting in place relevant legal and financing frameworks and physical infrastructure.

Firms in the automotive sector are facing constant developments in the area of advanced manufacturing, materials and the complexity of global supply chains. This will result in many jobs and processes needing to be redefined to take advantage of the potential that automation offers the sector.

- **Connected and Automated Driving (CAD), Advanced Driver Assistance Systems (ADAS)** [a][b][d][e][f][g][h][j][k][l][m][o][p]

These are aspects related to the assistance and automation of the driving activities to reduce road fatalities, minimise human errors and move a vehicle without driver active interventions

- **Electrification** [b][d][f][g][h][i][k][l][m][n][o][p]
  It is clear that running out of crude oil and the need for CO2 global reduction are both critical issues in Europe. Electrification in the whole powertrain is a possible strategy to tackle this issue.
- **Handling of / access to, vehicle data** [a][b][d][e][f][g][j][k][l][o][p]
  Increasing technology inside a vehicle and the relative necessity to be connected drive the needs to manage and access huge quantities of data quickly. Big data and analytics will allow players to optimise vehicle usage and forecast maintenance requirements (predictive maintenance).
- **Advanced manufacturing, digitalisation and robotization of the manufacturing process** [a][b][d][f][g][h][l][o][p]
  Firms in the automotive sector are facing constant developments in the area of advanced manufacturing, integrating the results of technological research into manufacturing process. Moreover, Manufacturing 4.0 can create efficiency and reduce (indirect) costs.
- **Alternative power trains** [b][d][g][h][k][l][m][n][o][p]
  The variation from internal combustion to a CO2 neutral mobility is directly connected to changes in power trains.
- **New communications technologies** [a][b][d][e][f][g][j][l][o][p]
  In the near future the vehicle will be connected, with digital technologies changing the way data is transferred and utilised. These new communication technologies have a key strategic importance in relation to changes in the sector.
- **3D printing** [a][l][p]
  It is a technology that can lead to a reduction in the costs of production as well as a reduction in defects and will also have an impact on jobs and skill requirements. Moreover, it is useful for rapid prototyping and advanced manufacturing and enables prototypes to be 'moved' between different players within the supply chain very quickly and efficiently.
- **New / advanced materials** [l][o][p]
  Modern car parts are increasingly made of lighter materials and these new / advanced materials are driving the strategies for future evolution in terms of product, design and performance.

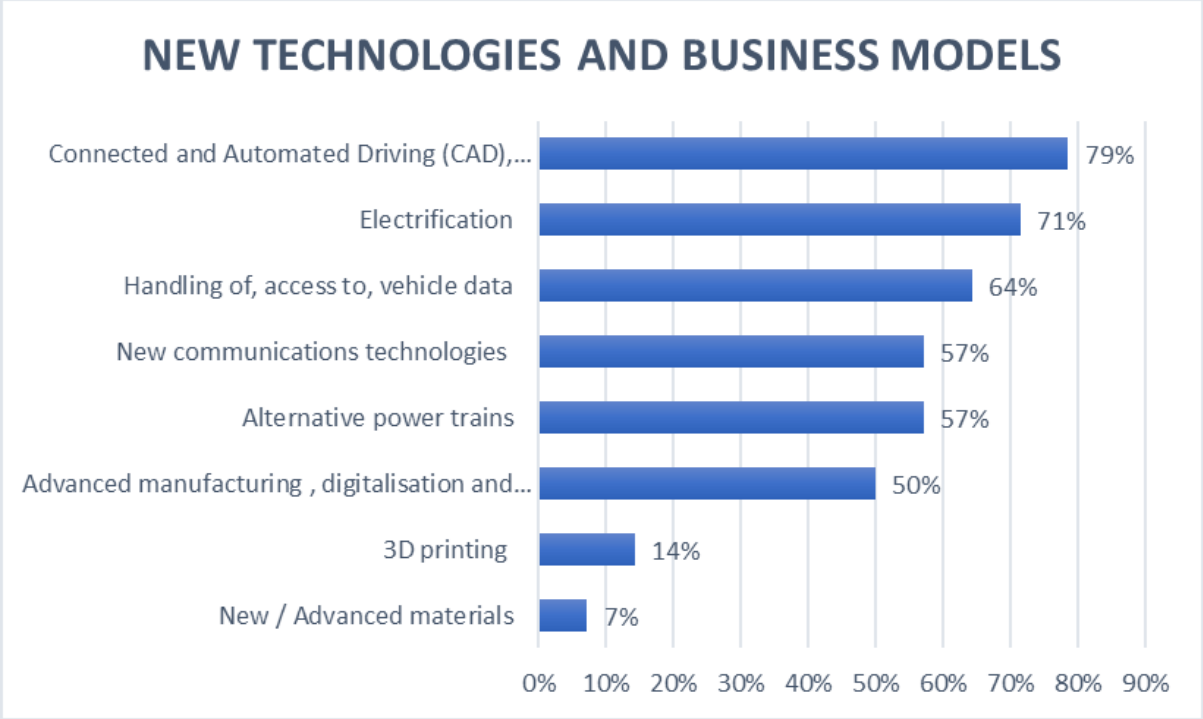

Figure 10: "New technologies and business models" Driver of Change presence in available literature (%).

Figure 10 identifies the frequency that each Driver of Change relating to New technologies and business models is mentioned in the wider literature review. The figure indicates that the most frequently mentioned Drivers of Change were Connected and Automated Driving, Electrification and Handling of, access to, vehicle data. This is followed by New communication technologies, alternative powertrains and advanced manufacturing, digitalisation. 3D printing and new/advanced materials were mentioned least.

3.3.3 CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES

The 2030 climate targets will require a significantly larger proportion of new cars to be low- and zero-emission. Encouraged by both consumer demand and public action, the automotive industry is stepping-up efforts to find viable alternatives that can reduce the negative effect of car pollution in the run up to 2030 and beyond. The process of managing the complete lifecycle of a product from concept to design, manufacture, service and disposal of manufactured products supports a reduction in waste and pollution, whilst at the same time providing opportunities for significant cost reductions and a need for new skills in different areas.

- **Batteries efficiency** [b][d][f][g][i][j][k][l][m][n][o][p]
  The necessity to store electric energy into a vehicle is an intrinsic necessity of a car. In the case of an electric vehicle, the battery can be compared to the gasoline tank of an internal

combustion engine car: it is the place where the energy to move the vehicle is stored. An increase in its efficiency means more range for the vehicle and a rapid refuelling.

- **Low and Zero-emission vehicles** [b][f][g][h][k][l][n][o][p]
  The automotive market is being challenged to develop more fuel-efficient engines and alternative powertrains to comply with the evolving standards in terms of pollution and CO2 emissions. Due to new international regulations consumers will have the possibility to choose from a mix of powertrains that best meet their lifestyle needs, for example, more efficient internal combustion engines, electric vehicles (EVs), hybrid electric (Plug-in Hybrid Electric Vehicle), and vehicles powered by natural gas.
- **Improved charging/refuelling infrastructure** [b][e][g][h][i][k][l][o][p]
  The needs for a widespread refuelling infrastructure is a key driver to boost the commercialisation of a technology based on a new fuel. The easier the access to a rapid refuelling infrastructure the quicker will be the development of such new technologies.
- **Greater range autonomy** [b][f][g][i][k][l][m][n][o][p]
  The introduction of a new technology must be compared with the existing one. The range autonomy of a vehicle is an essential factor to be considered when a new power train technology arises and innovations relating to this are a key driver of change in the sector.

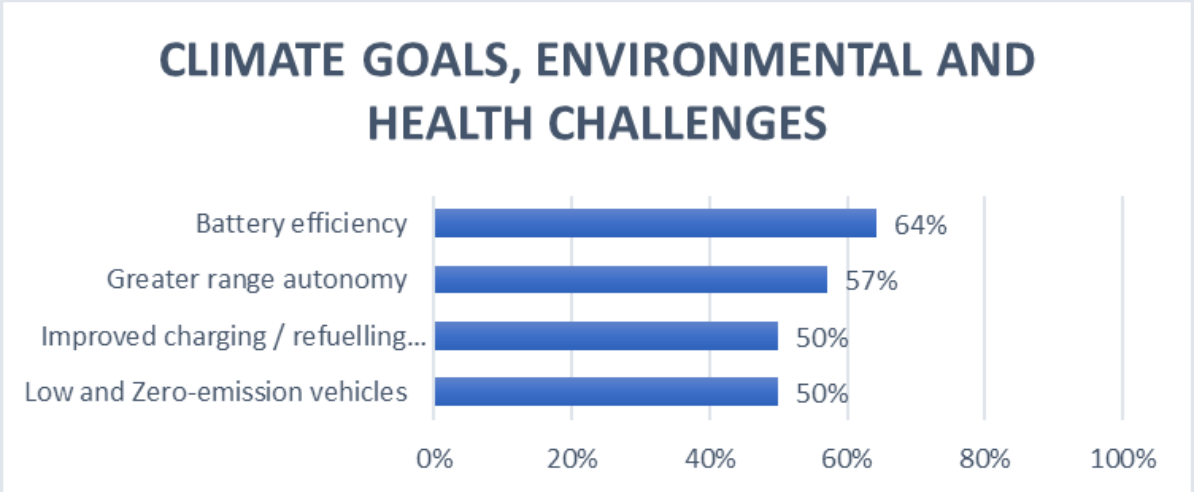

Figure 11: Climate goals, environmental and health challenges" Driver of Change presence in available literature (%).

Figure 11 identifies the frequency that each Driver of Change related to Climate goals, environmental and health challenges is mentioned in the wider literature review. The figure indicates that each of these Drivers of Change is mentioned a broadly similar number of times, with scores ranging from 64% to 50%. Battery efficiency is mentioned most frequently, followed by Greater range autonomy, Improved charging/refuelling infrastructure and Low and zero-emission vehicles.

3.3.4 SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS

The way that consumers access, purchase and use cars and other modes of transport is changing due to increasing connectivity and the greater use of e-commerce. New technologies and the massive use of the internet will have a huge impact on the use and concept of mobility (less product and more service). There is also growing public expectation that greater automation will lead to even higher standards of road safety and higher connectivity of vehicles. This development will also generate large amounts of new data and issues around Cyber Security. The demand for horizontal skills and occupations coming from other sectors will be influenced by these changes.

- **Mobility as a Service** [a][b][e][f][g][h][j][k][l][m][o][p]
  Car-sharing and ride-hailing mobile apps are a couple of examples of how the concept of mobility is changing, with consumers more and more interested in the "final service" than in the product. Using instead of owning might be an important driver changing the approach to product, market and services within the automotive sector.
- **Increased connectivity / infrastructure (V2X)** [a][b][d][e][f][g][h][j][k][l][o][p]
  A vehicle is a connected entity able to monitor, in real time, its own parts and safety conditions around it. This trend is growing, and the car of the future will be connected to other vehicles and to any entity that may affect the vehicle itself. The acronyms V2X refers to a form of technology that allows vehicles to communicate with moving parts of the traffic system around them and vice-versa. In this context, 5G infrastructure will be deployed along major terrestrial transport paths.
- **Data Access** [a][b][d][e][f][g][h][j][k][l][o][p]
  Higher connectivity of vehicles will also generate large amounts of new data. This will need to be considered as appropriate policy and legal solutions are found for the problems of vehicle integrity, security, road safety and liability. These will support the emergence of new business models and it is likely that this will include provision for direct, safe and secure access to a wide set of vehicle data for the provision of connected services.

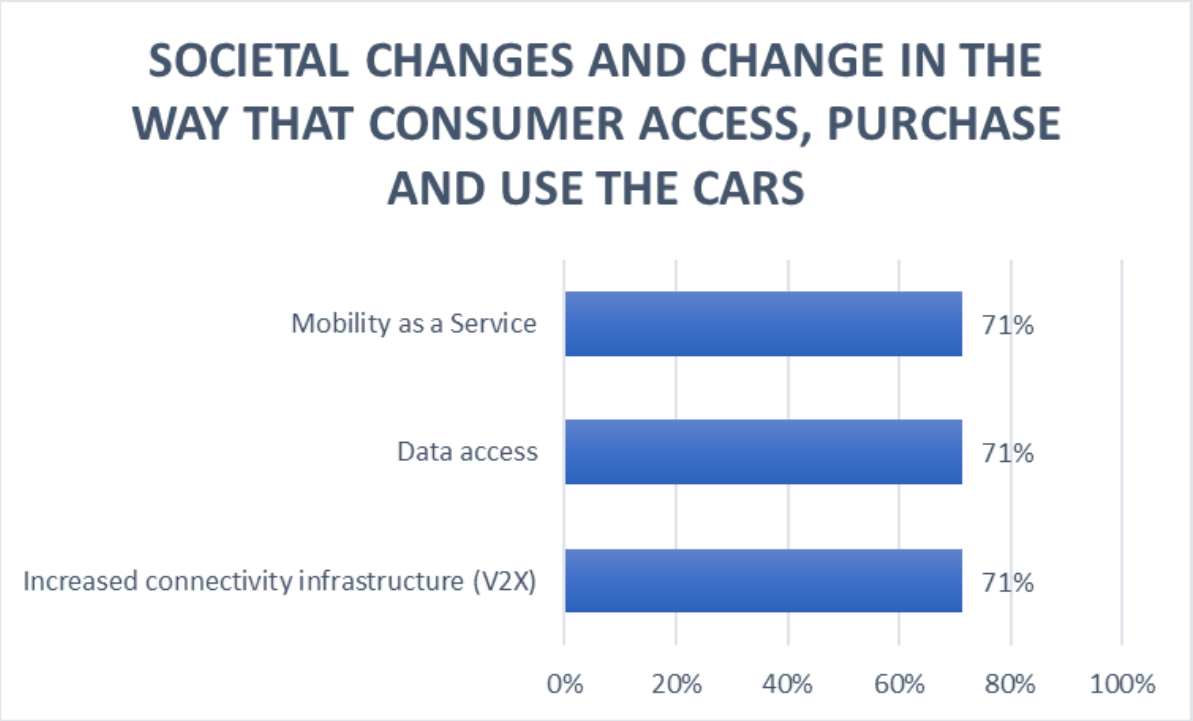

Figure 12: "Societal changes and change in the way that consumer access, purchase and use cars" Driver of Change presence in available literature (%).

Figure 12 identifies the frequency that the above Drivers of Change related to Societal and changes in the way that consumers access, purchase and use cars are mentioned in the wider literature review. The figure indicates that all three Drivers of Change were mentioned the same number of times, all recorded at 71%.

3.3.5 STRUCTURAL CHANGES

The automotive sector is a major European employer and the impact on the workforce resulting from the transition to new technologies will be significant. The demand for new skills and experience will equally result in a fall in demand for other more traditional skills. This implies a need for skills restructuring that addresses existing and emerging skills mismatches. This in turn, will require significant investment in new technologies, production processes and in the reskilling and training of the workforce.

- **Restructuring** [a][b][d][f][g][o][p]
  The European automotive sector is expected to undergo structural changes due to the development of digital technologies and the shift towards low and zero emission mobility. The industry, in particular SMEs, will need to assess and, if necessary, redefine their position in the value chain as well as increase their capacity to integrate digital technologies, alternative

powertrains and circular economy concepts in their products portfolio and production processes.

- **Acquisition of new skills** [a][b][d][f][g][o][p]
  The transformation of the automotive industry will have a significant impact on the industry's workforce and the acquisition of news skills will be a key factor enabling employees to be equipped to deal with these changes. These changes will lead to both the creation of new occupations and the need for new skills and competences amongst the existing workforce.
- **Continuous training** [a][b][d][g][o][p]
  Continuous training is always useful but during periods of disruptive change continuous training is essential to align competences to changing skill requirements. These activities also need to be supported by actions to improve mobility and transferability of skills, linked to the development of an efficient apprenticeship market and encouragement of informal learning.

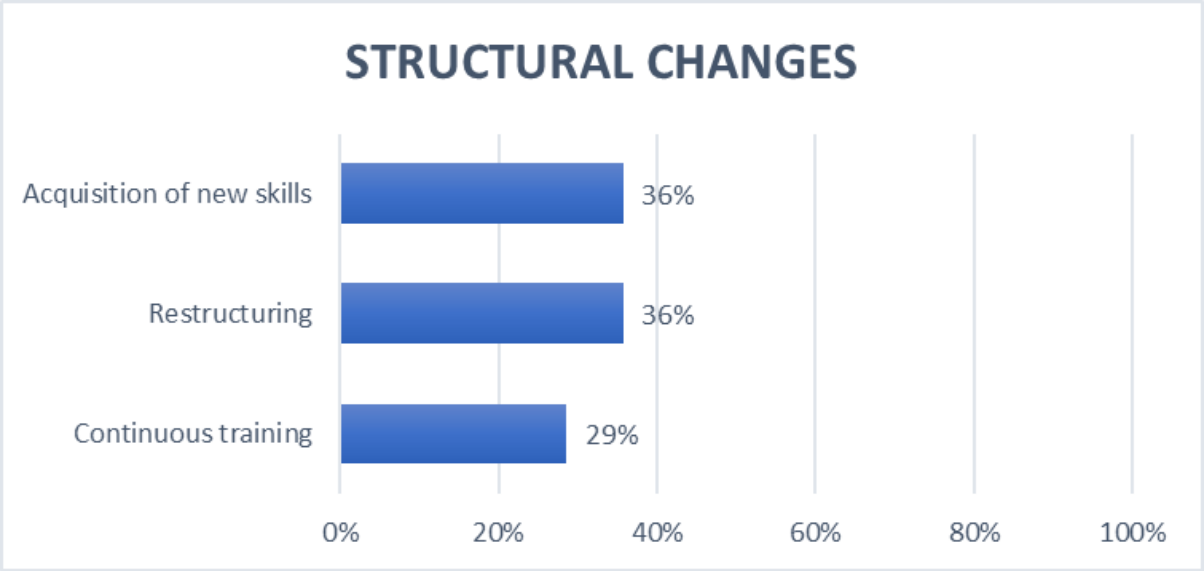

Figure 13: Structural changes" Driver of Change presence in available literature (%).

Figure 13 highlights the frequency that each of the above Drivers of Change related to structural changes is mentioned in the wider literature review. The figure indicates that these Drivers of Change are mentioned a broadly similar number of times, with values ranging from 36% to 29%. Acquisition of new skills and Restructuring are mentioned most frequently, followed by Continuous training.

3.3.6 GLOBALISATION AND RISE OF NEW PLAYERS

The EU automotive sector is facing growing competition from non-EU markets and competitors. Over the next few years, production in global markets is expected to grow strongly, whilst EU production is predicted to remain relatively flat. Maintaining the EU's global competitiveness will depend on ensuring high levels of investment in the new and emerging areas, especially in the area of product standardisation. This will need to be supported by global technical harmonisation developed through regulatory dialogue with the EU's main trading partners in order to guarantee a stable access to (key) raw materials.

- **Global technical harmonisation** [a][b][f][g][h][l][o][p]
  The supply chain structure within the Automotive sector will need to meet the challenges posed by the introduction of new technology but also meet changing market conditions. New mobility concepts; new standards and product harmonisations will also be necessary to create scale economies and to satisfy a possible increased demand for white label components and unbranded vehicles (for example, the possibility for new car-sharing brands to have a "standard" fleet where the core product is the service and not the car-brand).

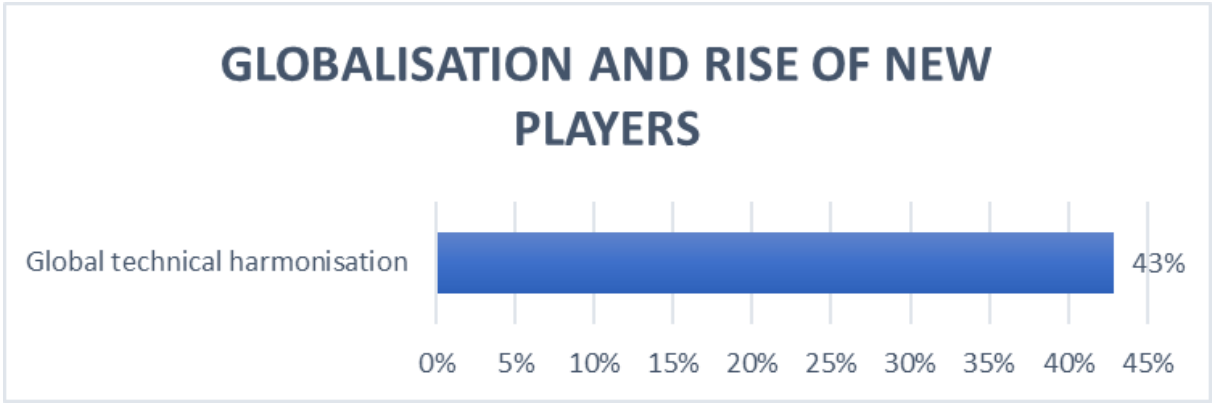

Figure 14: "Globalisation and rise of new players" Driver of Change presence in available literature (%).

Figure 14 indicates that in relation to Globalisation and rise of new players the main topic mentioned is Global technical harmonisation.

3.4 TARGET OCCUPATIONS AND SKILLS

Using ESCO taxonomy, an occupation is a grouping of jobs involving similar tasks and which require a similar skills set. Occupations should not be confused with jobs or job titles. While a job is bound to a specific work context and executed by one person, occupations group jobs by common characteristics.

WP2 partners identified 60 key automotive occupations. This is considered an important step in ensuring coherence of work undertaken as part of WP2 with ESCO and to support normalisation of survey results.

These 60 identified occupations include the following:

Five existing occupational profiles developed through the Automotive Sector Skills Council.

- Maintenance technician
- CNC operator/tool and die maker
- Paint technician/motor vehicle painter
- Assembly line operative/assembler
- Materials planning analysis

The following “emerging and or fast changing occupational profiles” also identified through Automotive Skills Council analysis:

- Product engineer
- Process engineer
- R&D engineer/technician
- 3D printing technician
- Product design and development technician
- Product developer
- Mechatronic technician
- Renewable energy specialist
- IT manufacturing system operator

The following Skills Alliance AQUA[15] new occupational profiles:

- ECQA Certified Functional Safety Manager (ISO 26262, IEC 61508)
- ECQA certified Lean Six Sigma Yellow Belt
- ECQA certified Lean Six Sigma Green Belt
- ECQA certified Lean Six Sigma Orange Belt
- ECQA certified Lean Six Sigma Black Belt
- ECQA Certified Automotive Quality Engineer Integrated
- ECQA Certified Automotive Engineer
- ECQA Certified integrated Design Engineer.
- ECQA Sustainability Manager

The full list of 60 “changing and emerging occupations” is included in the Appendix.

Skills are one of the most important pillars of the strategy that needs to be defined, with identification of future Skills needs a key objective of the Drives project. A preliminary set of skills have been investigated through desk-based research using available reports and intelligence. Skills identified through this approach have been documented at the same time as the analysis of Drivers of Change.

In order to conform to the proposal requirements identified skills have been classified according to ESCO taxonomy and aligned with action verbs (properly described in a work context). The identified skill sets have also been classified according to a list of work areas agreed by partners for this purpose:

- DESIGN & DEVELOPMENT
- DIGITAL
- HORIZONTAL
- MATERIAL KNOWLEDGE
- MARKETING AND COMMUNICATION
- ORGANISATION / MAINTENANCE
- ORGANISATION/MGM
- PRODUCTION/OPERATION
- QUALITY/TESTING

The results of the survey in relation to skills needs will be a core aspect of the overall findings. The partnership agreed to leave classification of skills as an open-ended question in the survey with normalisation of results undertaken collectively after data has been captured.

15 *https://www.ecqa.org/*

Background analysis relating to skills undertaken prior to the survey adopted the same approach as that utilised in relation to Drivers of Changes. With the starting point always results of analysis undertaken for GEAR2030 and the Skill Council Automotive (using the ESCO taxonomy -action verbs[16]-). The outcome of this analysis is outlined in Figures 15 and 16.

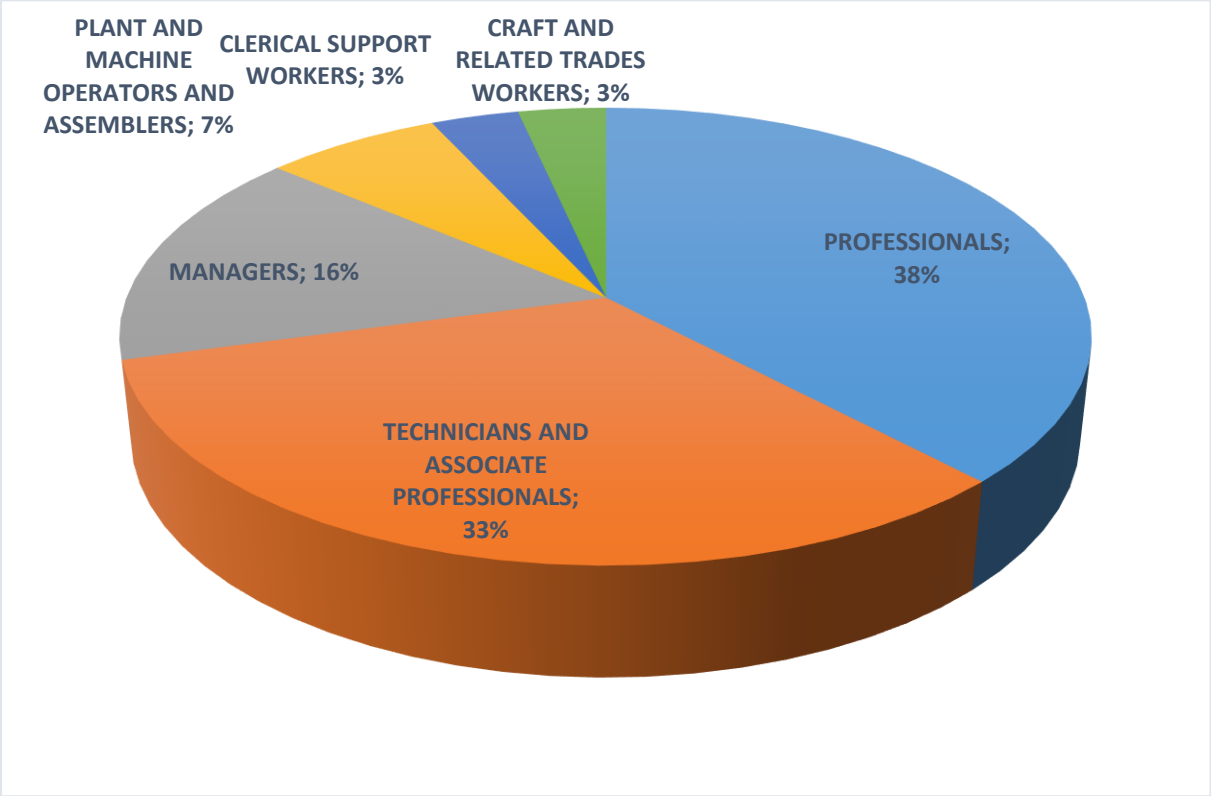

Figure 15: Analysed occupations by ISCO Classification level I.

Figure 15 identifies the percentage of people employed in each main (Level 1) occupational group according to ESCO[17] level I. The analysis indicates that Professional together with Technicians and Associate Professionals comprise over 70% of the total workforce, followed by Managers (15,5%).
More detailed analysis using ISCO classification (Level 2) underlines as per Figure 16 the predominance of Professional occupations comprising with 66,6% of the total. If Managerial occupations are also included the total is more that 80%.

16 https://europass.cedefop.europa.eu/documents/european-skills-passport/certificate-supplement/action-verbs-glossary

17 *https://ec.europa.eu/esco/portal/occupation?conceptLanguage=en&full=false#&uri=null*

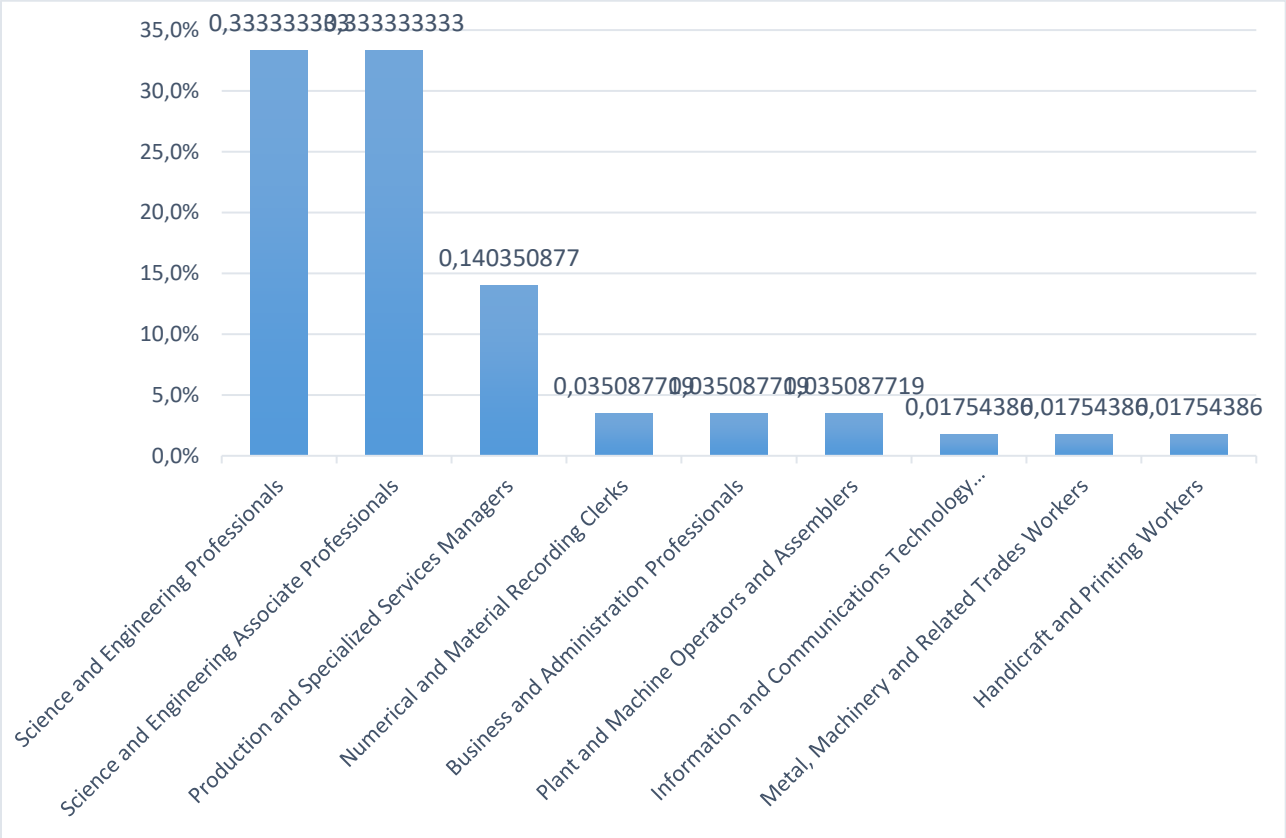

Figure 16: Analysed occupations by ISCO Classification level II.

The desk- based analysis therefore underlines the growing importance of high-level occupations within the automotive workforce. The analysis set out in figures 15 and 16 will be compared with the outcomes from the WP2 questionnaire.

A clear view of the future of the sector can be summarised as follows: "the industry workforce will be cut by at least 50 percent by 2030, and employees who remain will need very different skills. Automakers must become data managers and mobility service providers as well as vehicle assemblers"[18] together with "skills and competences of OEMs (will) shift into the software and electronics knowledge of the dealer-based customer service professionals"[19].

18 *Transforming vehicle production by 2030 – How shared mobility and automation will revolutionize the auto industry, PricewaterhouseCoopers, 2018*

19 *Ready for inspection – the automotive aftermarket in 2030, McKinsey, 2018*

The automotive factory worker 4.0 will be a technician who has experience of traditional machines integrated with skills that include cloud, data, automatic correlations, numerical control: a hybrid figure, which combines the classic analogue maker with digital skills[20].

It will be necessary for an ever-increasing interaction and integration between man and machines since Artificial Intelligence[21] will be increasingly important and guarantee greater safety standards; workers in factories will have roles required to control and supervise the system and to solve problems. The assembly will be performed by robots with the tendency being to use ready-built and plug & play parts to make activities more efficient and faster.
Generally speaking, workers will need to be multi-skilled in three areas of mechanical, electrical and electronics with technical and leadership abilities increasingly required[22].

3.5 VET, EQF & RECRUITMENT

The desk-research analysis provided certain information relating to the following areas:

- VET provision mechanisms
- Skill recognition and qualification frameworks
- Recruitment and attractiveness of the sector

In relation to these areas the information available is more limited and sometimes focussing on a single nation. The decision to include these sections as part of the on-line survey was linked to recognition of the limitations of readily available information elsewhere. As outlined in previous chapters, of this report, training programmes will be necessary to try to address changing skill needs of the industry and initiatives to tackle this issue should be encouraged across the automotive sector[20]. It is also clear that leaders will have to create a new culture of "always on" learning and development and develop strategies to attract new and young talent together with mechanisms to ensure continuous improvement of the skills of those recruited[23].

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20 https://www.ilsole24ore.com/art/tecnologie/2018-10-15/le-competenze-futuro-ripartono-persone-e-nuovi-linguaggi-172410.shtml?uuid=AETplKLG

21 *Transforming vehicle production by 2030 – How shared mobility and automation will revolutionize the auto industry, PricewaterhouseCoopers, 2018*

22 www.automotivecouncil.co.uk

23 *Making the future of mobility work, Deloitte, 2017*

In order to capture stakeholder views on the above issues the following specific sections of the questionnaire were added:

- **VET PROVISION MECHANISMS**: Designed to help understand the preferences of stakeholders in relation to the most appropriate VET mechanisms to meet changing needs, but provide information to help orientate the design of all project work packages;
- **SKILLS RECOGNITION AND QUALIFICATION FRAMEWORKS**: to obtain structured information on the current use of specific Recognition and Qualification frameworks and on the perceived importance of harmonisation activity at an EU level;
- **RECRUITMENT AND ATTRACTIVENESS OF THE SECTOR**: Designed to enable a greater understanding of stakeholder views relating to the necessity to increase the attractiveness of the sector for new and talented (young) workforce.

4 VISION OF THE SECTOR

The overall vision of the sector is moving from the vehicle to the integration of services around the product itself. The vehicle of the future no longer functions solely as a mode of transportation, but also as a place for work, relaxation and social interaction. Therefore, the driver can choose to drive themselves or be driven, meaning that the time spent in the car can be used for whatever the customer chooses.

Today, more than half the world's population lives in major cities[24] and this trend is growing. Mobility services like car-sharing and ride-hailing will be increasingly important, as the increase in traffic means mobility has to become more individualised. Coupled with this, younger generations no longer want to own a car[25]; parking has become more crowded in cities and the use of congestions-taxes is increasing.

One of the main outcomes of the next years scenario is that "Connectivity, and later autonomous technology, will increasingly allow the car to become a platform for drivers and passengers to use their transit time for personal activities, which could include the use of novel forms of media and services"[26]

An acronym used to explain the sector has been created by PricewaterhouseCoopers (EASCY)[27] to indicate a vehicle that is Electrified, Autonomous, Shared, Connected and "Yearly" updated. PwC detail the acronyms as:

- **Electrified**: The transition to emissions-free individual mobility would hardly be possible without the electrification of the drive train. First, there is the issue of local components – the fact that cars now only emit very low levels of harmful substances, dust and noise. It also seems that going "emissions-free" will be a global initiative: The idea is that the electricity used to charge the vehicles will come from renewable sources to ensure CO2-neutral mobility.
- **Autonomous**: The rapid progress made in areas such as artificial intelligence, machine learning and deep neural networks make it possible to achieve what until recently seemed utopian – namely the development of autonomous vehicles, which require no human intervention even in complex traffic situations. This will completely redefine

24 https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

25 *Global Automotive Consumer Study - The changing nature of mobility, exploring consumer preferences in key markets around the world, Deloitte, 2014*

26 *Automotive revolution – perspective towards 2030, McKinsey, 2016*

27 *Five trends transforming the Automotive Industry, PricewaterhouseCoopers, 2017-2018*

the use of individual mobility platforms. New application scenarios are emerging that would have been unthinkable just a few years ago[28].

- **Shared**: For several years, many big cities have offered car-sharing facilities. While these are currently often run as pilot projects or citizen initiatives, sharing concepts will become economically viable with the introduction of autonomous vehicles. It will no longer be necessary to search for a shared vehicle in the surrounding area: instead it will be possible to order vehicles to wherever the user happens to be via a convenient "on demand" service.
- **Connected**: This term actually represents two concepts at once. On the one hand, it applies to Car2Car and Car2X communication, which is the networking of the car with other cars or with the transport infrastructure (such as traffic lights). On the other hand, the term also covers the networking of vehicle occupants with the outside world. In future, they will be able to communicate, work, surf the internet or access multi-media services during the journey.
- **Yearly updated**: The development topics of electrified, autonomous, connected and shared will lead to a clear increase in the rate of innovation within the automotive industry. Model cycles of five to eight years, which have always been common in this sector, could soon be a thing of the past. Instead, the range of models will be updated annually in order to integrate the latest hardware and software developments. As customers will naturally not want to buy a new vehicle every year due to the high purchase costs, the short innovation cycles will enter the market primarily through regular upgrades of shared vehicles.

In the literature there are several acronyms to explain the future vision of the automotive sector, even if all of them share the same basic elements. These milestones, related to the direction of the development of the "vehicle" product will influence all related automotive sectors and its value chain:

- **Transit time for personal activities**

  The vehicle of the future will be "a place to do activities" and to take advantage of the transit time to allow personal activities. The necessity of connection (V2X) will be more and more important. This is not just as a result of growing amount of information that a vehicle, by its nature, generates for technical reasons, or data currently imported from external sources (for example the mobile phone interaction with vehicle's infotainment systems or information transmitted by roadside units, other vehicles or vulnerable road users),[29] but the huge amount of information that is expected to be exchanged.

28 *Amazon dives into self-driving cars with a bet on Aurora, 2019, www.wired.com, https://www.wired.com/story/amazon-aurora-self-driving-investment-funding-series-b/*

29 *What kind of data can my car share?, CarDataFacts.eu, 2017, http://cardatafacts.eu/data-can-car-share/*

- **Infrastructure**[30]

  Public charging points that refill EVs will have to rise significantly to meet the global EV-adoption increases forecast by 2030[31]. Even if the direction seems to be clear, the speed of the transition is still uncertain: a fundamental shift is driving a move away from personally owned, driver-driven vehicles and toward a future mobility system centred around driverless vehicles and shared mobility, with an electrified engine in order to conform with the European CO_2 targets.

  "According to the European Environment Agency (EEA) report[32], specific incentives for electric vehicle charging points were found in only 10 out of 28 EU countries. The European Automobile Manufacturers' Association (ACEA) cautions that investments need to be stepped up, as future reductions of CO_2 emissions from cars and vans are strongly dependent on increased sales of electric and other alternatively-powered vehicles"[33]; in 2019 a new analysis made by ACEA, with a specific focus on truck sector, has underlined that in EU28 no suitable infrastructure are still available[34].

- **Car as a service**

  With a "rethinking ownership" paradigm where it will no longer be necessary to own an automobile due to the fact that new mobile devices, their diffusion, GPS technology and big data transfer are driving consumer behaviour "to use a vehicle only as needed and foregoes the responsibilities of ownership[35]". New generations are not devoted to their "own car" and so do not need a driving licence to use it[36]. Moreover, the traffic increase in the major European capitals will require a new approach to mobility.

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30 *Forces of change: the future of mobility, Deloitte, 2017*

31 *Three surprising resource implications from the rise of electric vehicles, McKinsey, 2018*

32 https://www.eea.europa.eu/themes/transport/vehicles-taxation/appropriate-taxes-and-incentives-do/table-1-summary-of-the/view

33 *Insufficient support for electric vehicle charging infrastructure hampers uptake, new report shows, ACEA, 2018, ttps://www.acea.be/press-releases/article/insufficient-support-for-electric-vehicle-charging-infrastructure-hampers-u*

34 *Truck CO2 targets: no public charging points for electric or hydrogen trucks available, data reveals, ACEA, 2019, https://www.acea.be/press-releases/article/truck-co2-targets-no-public-charging-points-for-electric-or-hydrogen-trucks*

35 *A road map to the future for the auto industry, McKinsey, 2014*

36 *Global Automotive Consumer Study - The changing nature of mobility, exploring consumer preferences in key markets around the world, Deloitte, 2014*

- **Product standardisation**

  Within a more complex and diversified mobility industry landscape, incumbent players will be forced to simultaneously compete on multiple fronts and cooperate with competitors[37]. No wonder, for example, that BMW, Volkswagen and Daimler, the maker of Mercedes-Benz cars, are in talks on a formal collaboration to work on key technologies and industry standards for autonomous driving. Major parts suppliers, including Bosch, Continental and ZF, are also known to be taking part[38].

- **Value chain**

  Several scenarios and visions have been found on the transformation of the automotive value chain, in many of which the roles of the OEMs will be increasing, even if IT actors can drive the change and turn OEMs (only) into the supplier of hardware platforms[39]. OEMs will improve the process and cost efficiency and may be able to create standards in a market where the attractiveness of the brand will decrease. Common online platforms could link global supply and demand to increase efficiency throughout the supply chain. The IoT should allow a precise monitoring of the performances of vehicles and of all the components[40].

- **After sales**

  Continuous technological progress has seen in recent years the modern automobiles become real "traveling laboratories" in recent years, equipped with electronic driver assistance systems developed to protect the safety of driver and passenger as much as possible. These electronic aids are referred to by the acronym ADAS[41] (Advanced Driver Assistance Systems), identifying all the devices on the car to increase driving comfort and safety levels. ADAS and autonomous vehicles are expected to reduce aftermarket revenues[42] and a shift between car-damage-repair to car-predictive-maintenance is expected; big data and advanced analytics will

37 *Automotive revolution – perspective towards 2030, McKinsey, 2016*

38 *VW, BMW and Daimler hold talks on cooperation in self-driving cars, Handelsblatt Today, 2019, https://www.handelsblatt.com/today/companies/autonomous-plans-vw-bmw-and-daimler-hold-talks-on-cooperation-in-self-driving-cars/23909322.html?share=mail&ticket=ST-50130-CAVWtuUQ361p6LtTeMWh-ap1*

39 *The future of the Automotive Value Chain – 2025 and beyond, Deloitte, 2017*

40 *A road map to the future for the auto industry, McKinsey, 2014*

41 *https://www.automobile.it/magazine/come-funziona/adas-sistemi-avanzati-assistenza-guida-3382*

42 *Ready for inspection – the automotive aftermarket in 2030, McKinsey, 2018*

allow aftermarket players to store and process vehicle, customer, and vehicle usage data to optimize the value chain end-to-end based on predictive maintenance[43].

The real innovation for brands, will be to invest in an efficient and effective after-sales service that exceeds customer expectations[44]: A pro-active and efficient after-sales service department means great advantages, these being:

- A satisfied customer with associated positive word of mouth feedback
- Increasing the sales of original spare parts and services
- Optimization of processing times to benefit the whole supply chain (person-hours)

- **Row material**

Battery manufacturers and OEMs in the automotive industry will need to develop financial and economic strategies to ensure a stable supply of raw materials[45] (eg lithium, cobalt or graphene). This need requires car manufacturers to adopt medium-term strategies and strong key agreements with some nations. A long-term strategy that analyses and evaluates new technologies and potential new raw materials for batteries should also be considered, with the European Commission and in general Governments and public administrations playing a fundamental role in the elaboration of policies and strategies.

43 *Ready for inspection – the automotive aftermarket in 2030, McKinsey, 2018*

44 *Il vero motore dell'automotive? L'assistenza post vendita, Linklesta, 2018*
https://www.linkiesta.it/it/blog-post/2018/04/17/il-vero-motore-dellautomotive-lassistenza-post-vendita/26816/

45 *Lithium and cobalt: A tale of two commodities, McKinsey, 2018*

5 RESULTS

It is evident from the desk-based research undertaken that the automotive sector will undergo major changes, driven by heterogeneous drivers of change. The overall importance of the automotive sector to economic activity in Europe is highlighted by Figure 17, which indicates that the automobile and parts sector in Europe is responsible for 27% of the region's total R&D spending[46] and that over 8,700 automotive patents were granted by the European Patent Office in 2017.

46 *ACEA Pocket Guide 2018 – 2019, ACEA, 2018*

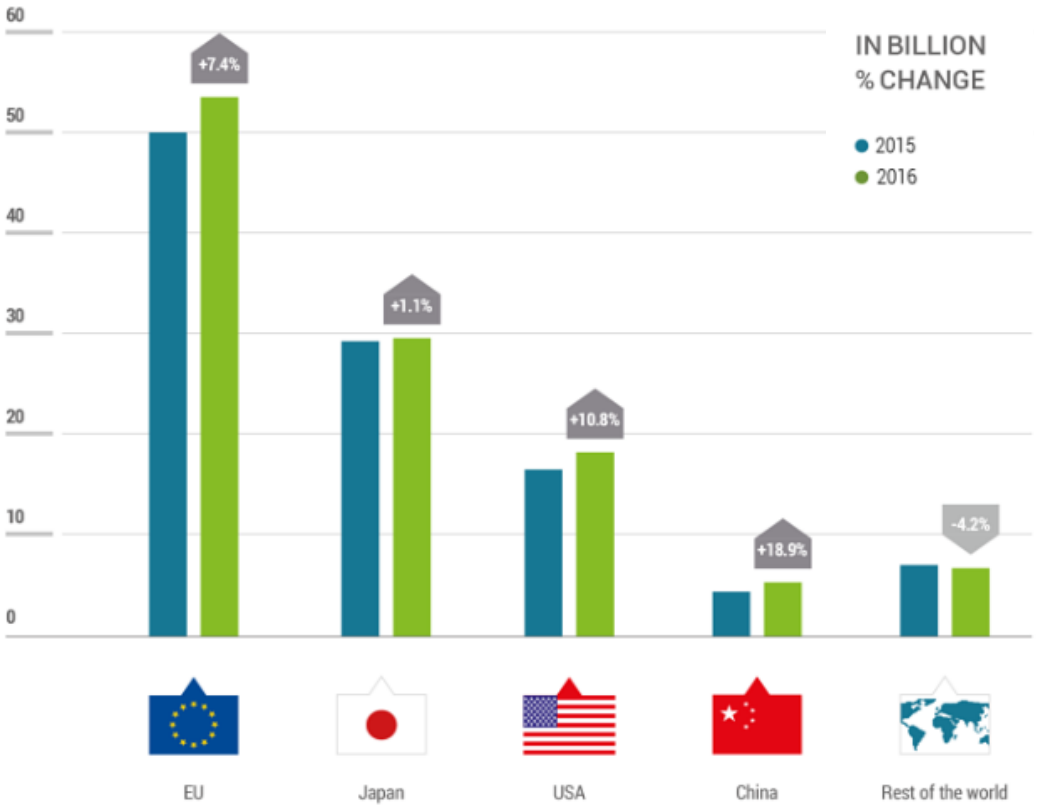

Figure 17: World investors in automotive R&D (ACEA, 2018).

According to ACEA:

13.3 million people – or 6.1% of the EU employed population – work directly and indirectly in the sector. The 3.4 million jobs in automotive manufacturing represent over 11% of total EU manufacturing employment. Motor vehicles account for some €413 billion in tax contributions in the EU15 alone – almost three times the total EU budget. The automobile industry exported 5.9 million motor vehicles in 2017, generating a trade surplus of €90.3 billion for the EU.

In a world that is evolving more rapidly towards new technologies and where the security and use of Big Data are becoming an essential element in the development of commercial strategies, the automotive sector is going to experience a new epochal change, perhaps greater than that experienced in the early 20th century with industrial automation in U.S. factories. Given this, it is necessary to anticipate the R&D needs and associated changes in the skills and competences that training institutes in Europe will have to teach (young) people who want to develop a career path in this field. Although there are a number of different future scenarios, in practice all imply the emergence of new occupations and major reskilling in relation to existing occupations.

The results provide the foundation (**BASE**) of the project and can be summarised as:

- **B**: Big Data
- **A**: ADAS and After sales
- **S**: Supply chain and Sharing
- **E**: Electrification

- ***BIG DATA***

"Big Data" refers to the possibility of collecting and managing a huge set of heterogeneous information. Along with many other sectors it is clear that the Digitization of the automotive sector and the collection and analysis of related (big) data and analytics will lead to new sources of value generation and forecasting efficiency as well as impact on operations and performance. With the collection and analysis of data variables such as cybersecurity and transfer speed (of data) come into play, together with new ways of managing data. The following figure highlights potential threat vectors.

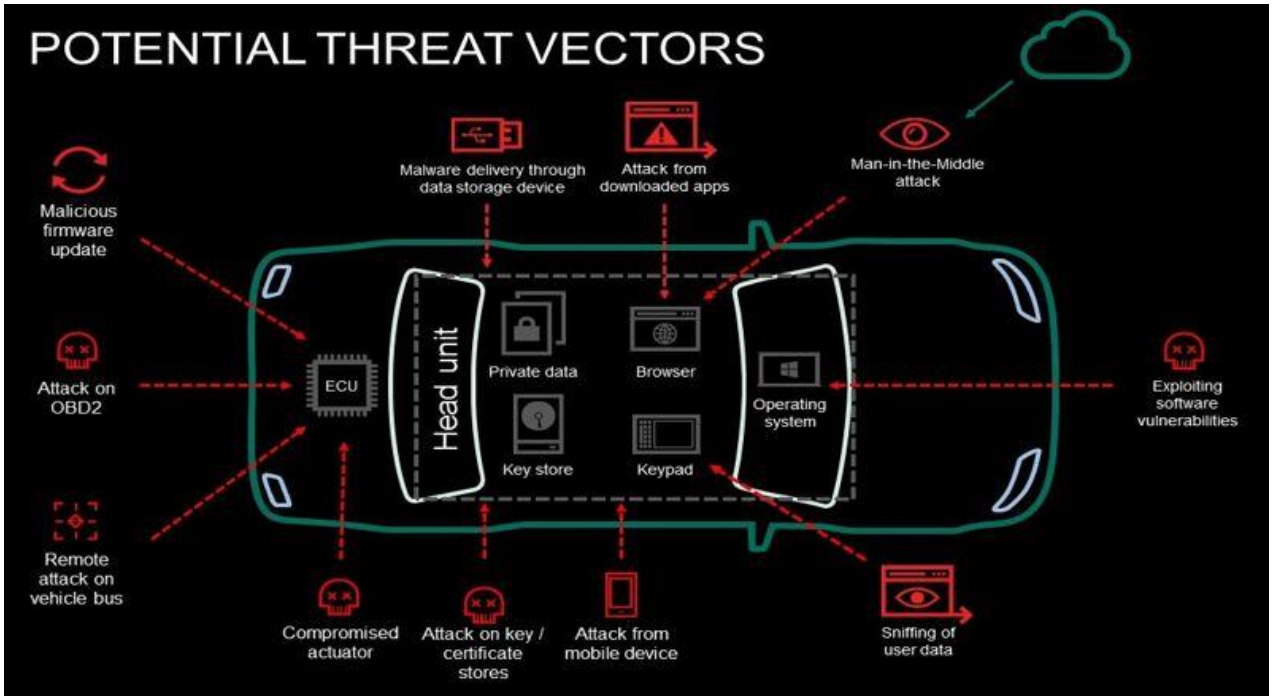

Figure 18: Potential threat vectors for a vehicle by Kaspersky. (https://www.kaspersky.com/blog/connected-cars-secure-by-design/16947/)

The exchange of information and data analysis will cover every aspect of the sector (and related supply chain) and is already pivotal to the transformation of the sector itself. Big Data players like Google, for example, are already working to integrate their platforms directly into the car from the current "projected solution" (Android Auto App) with a "Native Android Auto" technology integrated into the vehicle[47].

- ***ADAS***

Advanced Driver-Assistance Systems will be a mandatory part of a car: By 2030 vehicles will be able to drive autonomously in safety and be covered by EU legislation[48].

A non-exhaustive list of current available systems is[49]:

- Adaptive cruise control (ACC)
- Glare-free high beam and pixel light

47 *The head of Android Auto on how Google will power the car of the near future, The Verge, 2019, https://www.theverge.com/2019/1/25/18196234/google-android-auto-in-car-systems-apple-carplay-interview*

48 *https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/setting-the-framework-for-car-connectivity-and-user-experience*

49 *https://en.wikipedia.org/wiki/Advanced_driver-assistance_systems*

- Adaptive light control: swivelling curve lights
- Anti-lock braking system
- Automatic parking
- Automotive navigation system with typically GPS and TMC for providing up-to-date traffic information.
- Automotive night vision
- Blind spot monitor
- Collision avoidance system (Pre-crash system)
- Crosswind stabilization
- Cruise control
- Driver drowsiness detection
- Driver Monitoring System
- Electric vehicle warning sounds used in hybrids and plug-in electric vehicles
- Emergency driver assistant
- Forward Collision Warning
- Intersection assistant
- Hill descent control
- Intelligent speed adaptation or intelligent speed advice (ISA)
- Lane centering
- Lane departure warning system
- Lane change assistance
- Night Vision
- Parking sensor
- Pedestrian protection system
- Rain sensor
- Surround View system
- Tire Pressure Monitoring
- Traffic sign recognition
- Turning assistant
- Vehicular communication systems
- Wrong-way driving warning

All the ADAS technology is software-based and its importance will increase rapidly in the next years; according to McKinsey, "software represents 10 percent of overall vehicle content today for a D-segment or large car with the average share of software expected to grow at a compound annual rate of 11 percent, to reach 30 percent of overall vehicle content in 2030. Not surprisingly, players across the digital automotive value chain are attempting to capitalize on innovations enabled through software and electronics"[50]. The following figure shows Levels of automation and associated timelines based on information from European Parliamentary Research Service (EPRS).

50 *Reserve a seat, the future of mobility is arriving early, McKinsey, 2018*

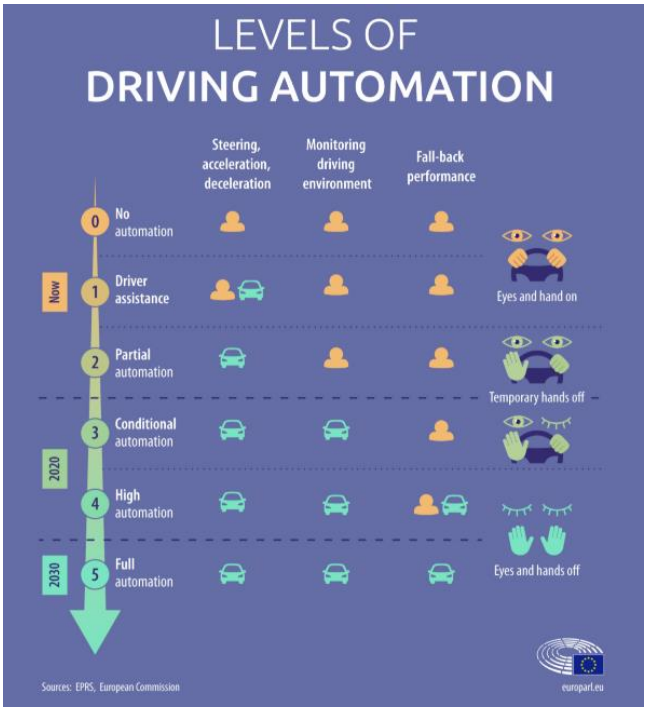

Figure 19: Levels of automation and timeline expected on the market between 2020 and 2030.

The Automation driving levels will increase during the 2020-2030. In the last century only few active automation innovations have been introduced. Figure 19 shows that in the next 10 years the full automation driving level will be completed.

The automotive industry is changing from “hardware” to “software”, where the content of software and electronics in vehicles are increasing rapidly; in this scenario, Artificial Intelligence and IoT are driving the transformation. In coming years, the self-driving vehicles’ market is expected to grow exponentially, creating new jobs and developing profits for the EU automotive industry of up to €620 billion by 2025[51].

- ***AFTER SALES***

As seen from the previous points, the future scenarios of the sector show a vision where AI and ADAS will be increasingly effective and efficient. It is therefore logical to presume a trend in which autonomous driving leads to fewer accidents. The after-sales activity will pass from a "passive repair"

51 *Self-driving cars in the EU: from science fiction to reality, European Parliament, 2019, http://www.europarl.europa.eu/news/en/headlines/economy/20190110STO23102/self-driving-cars-in-the-eu-from-science-fiction-to-reality*

to an "active maintenance" service. Current and future analysis systems, combined with IoT, will be able to process large amounts of data and provide analytical methods and precognitive models, identifying potential errors and failures in advance, offering opportunities for the development of repairs and solutions. This will also make maintenance of the vehicle more preventive, as monitoring on all systems will clarify the problems before a failure occurs. All this helps to keep vehicles at optimum performance, increase efficiency and reducing costs. In addition, by increasing sharing services and mobile apps (see the following "Sharing" point below), after-sales service will move to a “fleet management approach”.

More than in the past, an excellent post-sales strategy will be essential to the positioning of the brand and the perception that customers have, particularly in relation to standardisation of the product[52]: an “important brand” will always offers a high-level after-sales service as this aspect has implications on the profitability for the companies involved, but also economic benefits for the customers, who receive an improved content and value from the product over time.

- ***SUPPLY CHAIN (DISRUPTION)***

This aspect of the Automotive sector is likely to experience major disruptions by 2030.
This is summarised by Deloitte as “with increasingly better possibilities of data analysis, predictive analytics is developing into a powerful tool allowing for an enormous boost in forecasting efficiency as well as operations and performance”[53], with the value chain subjected to OEMs platform standardisation and industry consolidation and integration[54].
The Disruption along the value chain will not only be driven by existing operators in the sector, but also by new outsiders such as software component manufacturers, new electric vehicle manufacturers (for example BYD, BAIC or ZhiDou) and multinational companies that until recently had a different core business (for example Apple and Google). Moreover, the growth of e-commerce platforms will change the traditional business of spare parts distributors and workshop activities will see the proliferation of specialized players (also linked to the standardization of the product and the proliferation of Plug & Play spare parts). These changes in the nature of the value chain will be reflected in an increased

52 *Dealer di successo, le sfide delle concessionarie auto del futuro, tra mobilità sostenibile, digital e profittabilità, Bain & Company, 2018*

53 *Cracking the code for global supply chain management, extract from “Big data and analytics in the automotive industry”, Deloitte, 2015*

54 *Perché FCA ha venduto Magneti Marelli ai giapponesi di Calsonic, IlSole24Ore, 2018*

transparency of prices for customers along the value chain and a shift from private to business needs, due to an increased share of operators of professional fleets in the after-sales market.

It is not only technical occupations and skills that will be influenced by this transformation. The role of salespeople and dealers will change: car-buying behaviour is changing in ways that will force a radical and disruptive revolution in auto sales[55].

- ***SHARING***

Carsharing is a way to explain an emerging class of "mobility services" that draw on modern technology to enable access to car-based mobility, without the consumer owning the vehicle. In contrast to the traditional approach of selling cars to end users, this requires new value propositions, new organisational structures, and new ways of interacting with the public sector[56].

Carsharing has continuously seen double-digit growth over last year and Europe represents over 50% of the total car sharing market, with 5.8 million users[57].

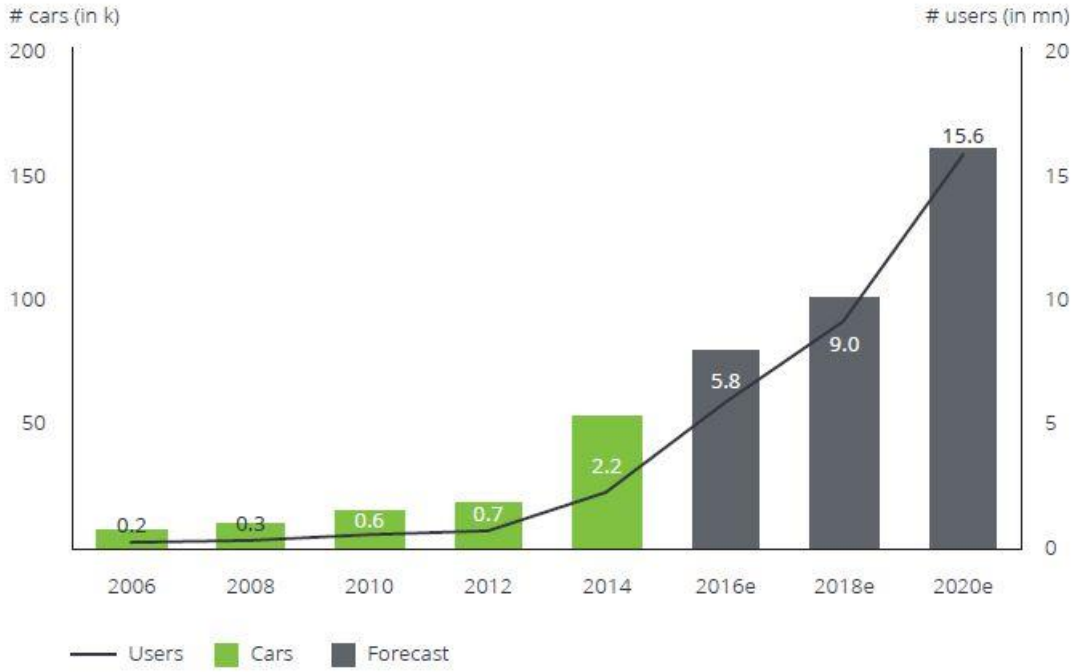

Figure 20: Car sharing market development for Europe* 2006-2020 by Deloitte (* DE, UK, FR, IT, CH, NL, SE, SP, BE, NO, DK).

55 *The Future of Car Sales Is Omnichannel, Bain & Company, 2017*

56 *Carsharing: Evolution, Challenges and Opportunities, ACEA SAG report, 2014*

57 *Automotive car sharing in Europe, Deloitte, 2017*

Figure 20 points to a rapid growth trajectory: new technologies applied on smartphones, the IoT and the analysis of big data related to the speed of data transfer have led to rapid growth and an expected upward future trajectory. This has been reflected in a growth of Also in this case, operators not belonging to automotive core business entering the sector with many others expected to enter as the product (car) drops to second place compared with the services offered and the flexibility of using the service itself. On the one hand, competencies linked to big data and IoT will be more and more important, with, on the other hand the necessity to increase the “fleet experience” skills.

- ***ELECTRIFICATION***

"Electrification" appears to be the overriding direction for the vehicle powertrain in the future. Automakers are preparing to phase out cars powered solely by internal combustion engines as governments look to tackle fuel emissions. The growth in electric vehicles (EVs) and hybrid electric vehicles (HEVs) is set to climb. By 2025, EVs and HEVs are expected to account for an estimated 30% of all vehicle sales. By contrast, in 2016 just under 1 million vehicles or 1% of global auto sales came from plug-in electric vehicles (PEVs)[58].

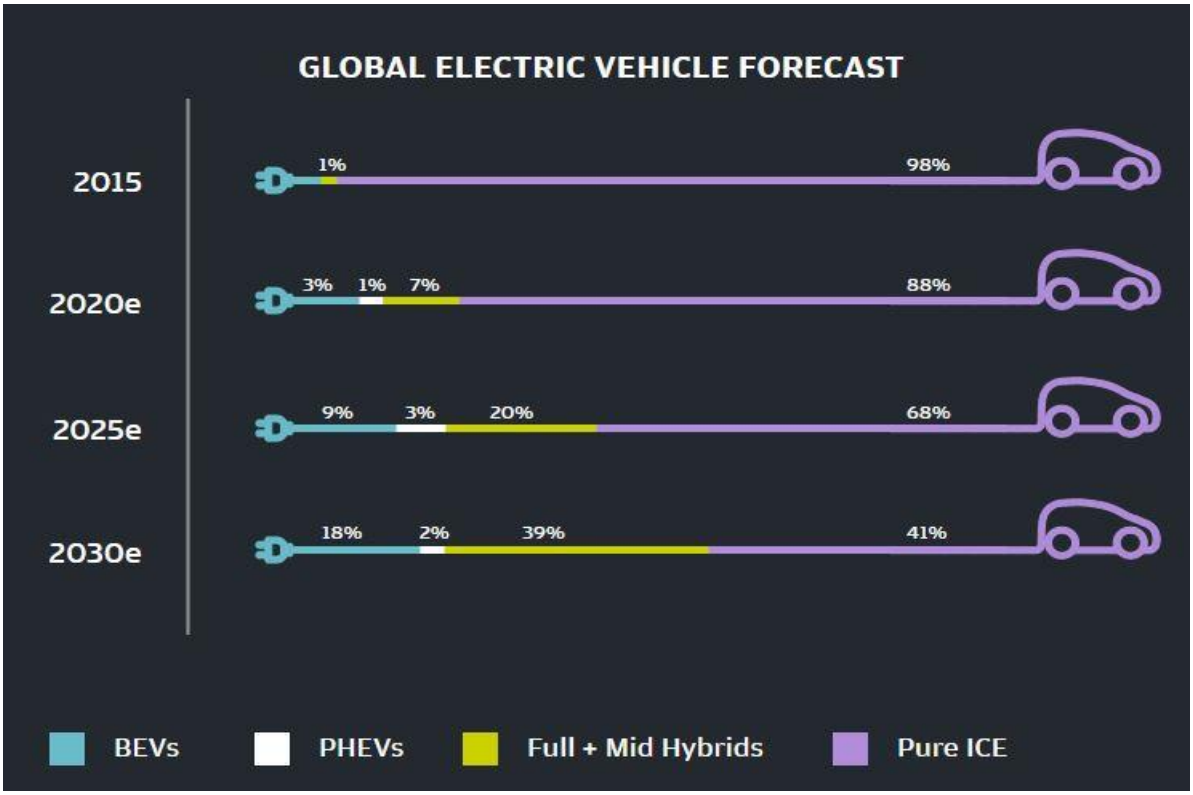

Figure 21: J.P.Morgan estimates evolution of the Global Electric vehicle market.

The transition to an all-electric future will require sizeable investments in R&D, the acceleration of vehicle charging infrastructure and potential legislation for the installation of charge points in new homes. Linked to this will be the necessity to create new skills for a new mobility concept, as this transition to EVs gains momentum. Whilst electric cars and lorries may account for a tiny percentage of vehicles on the road today (4 million electric vehicles versus over one billion petrol and diesel cars), adoption is accelerating fast. It took over 20 years to sell the first million electric cars. Now, more than one million electric vehicles have been sold in just one year[59]. It is important to underline that "all-

58 *Driving into 2025: The Future of Electric Vehicles, J.P.Morgan, 2018*

59 *Strong policy and falling battery costs drive another record year for electric cars, IEA (International Energy Agency), 2018*

electric" doesn't mean it is necessary for a vehicle to have a huge battery pack that stores energy like a fuel tank: the 2030 electric engine may also be powered by other energy sources like hydrogen as outlined under new start-up[60].

The **BASE** scenario provides an employment forecast in terms of expected number of jobs created set against the expected number of jobs lost.

A study from the European Association of electrical contractors (AIE) has assessed likely future job creation in a number of sub-sections of the electromobility production process and concludes that by 2030 a total of nearly 200,000 permanent jobs will be created. This is based on a moderate uptake of plug-in vehicles amounting to around 35% of new car sales by 2030. Of these 200,000 jobs, 57% will come from the installation, operation and maintenance of charging points[61]. It then compares this with a study by Germany's Fraunhofer research institute into the impact of electrification on jobs: an estimated 306,000 jobs in the automotive manufacturing sector will be lost in total by 2030, but only 27% of these (about 84,000) are expected to be specifically due to an increase in electromobility; the rest are expected to be the result of productivity improvements[62]. Although there are variations in some aspects of future expectations, all the reviewed literature regarding this topic is however in agreement that there will be a demand for new skills and competences and the emergence of new occupations not currently in existence[63].

60 *Electriq~Global Says Its Water-Based Fuel Can Power Your Car, But Details Are Thin, Forbes, 2018 https://www.forbes.com/sites/jeffkart/2018/11/14/electriqglobal-says-its-water-based-fuel-can-power-your-car/#390a34ee45ab*

61 *Powering a new value chain in the Automotive sector, AIE, 2018*

62 *Wirkungen der fahrzeugelektrifizierung auf die beschäftigung am standort Deutschland, Fraunhofer-Institut, 2018*

63 *Employers' Views of the Jobs and Skills Required for the UK Automotive Industry, Automotive Council UK, 2016*

6 THE QUESTIONNAIRE

The on-line survey is the tool that DRIVES partners have used to gather information from stakeholders. It has been designed as a self-completion survey with a wide range of 'open ended' questions in order not to pre-determine the range of responses. All individual responses collected through the survey will be treated confidentially and used in an aggregated manner, only for the purposes of the project.

As highlighted in figure 22 the survey is an integral component of the WP2 strategy and the integration of these results with the preliminary literature review will form the basis of the strategic roadmap for the project.

The questionnaire is designed to be as open as possible in order to gather as much information as possible to support our understanding and analysis of the sector's skills agenda and needs. The introduction section and the appendix are "necessary" to support the characterisation of the individual, company and job role of survey respondents. Survey outcomes will be always aggregated, and no personal / company information will be published. A harmonisation process will be necessary in order to prepare a structured map enabling aggregation of information and compilation of the stakeholder vision of the sector. The survey has been designed for two key types of respondent: Those representing companies operating within the automotive sector and those representing organisations involved in the automotive sector.

Looking in more detail, the specific categories of stakeholders involved in the DRIVES project are:

- Company:
  - SMEs
  - Large Enterprises
- Organisation:
  - Chambers of Commerce
  - Industrial Associations
  - Trade Unions
  - labour ministries
  - training and education providers
  - labour market intelligence entities
  - public and private employment services
  - national statistics offices

The current questionnaire has been designed to capture information relating to demand within the automotive industry. A further phase of the survey will involve design and implementation of a

questionnaire to capture views from training providers and other relevant stakeholders in relation to the current VET offer serving the automotive sector.

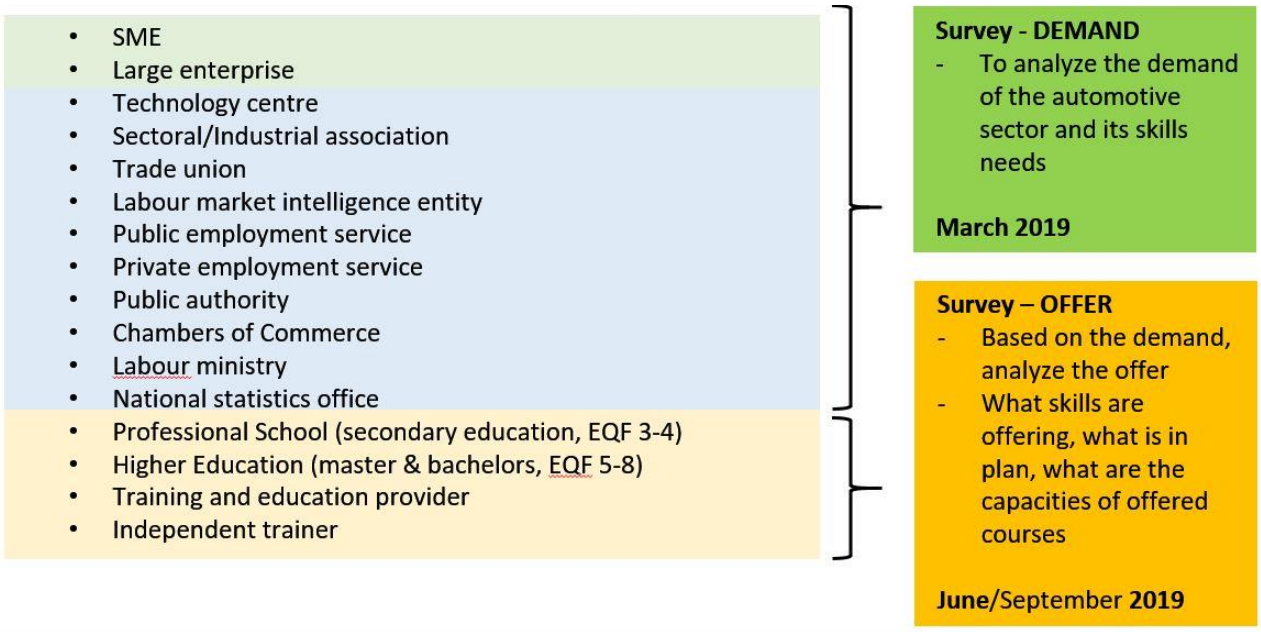

Figure 22: current and next stakeholders engagement.

The structure of the questionnaire is outlined in the figure 23 below:

Figure 23: Questionnaire scheme

Following a homepage section outlining the main guidelines and instructions the questionnaire comprises 7 further key areas as outlined in the following diagram:

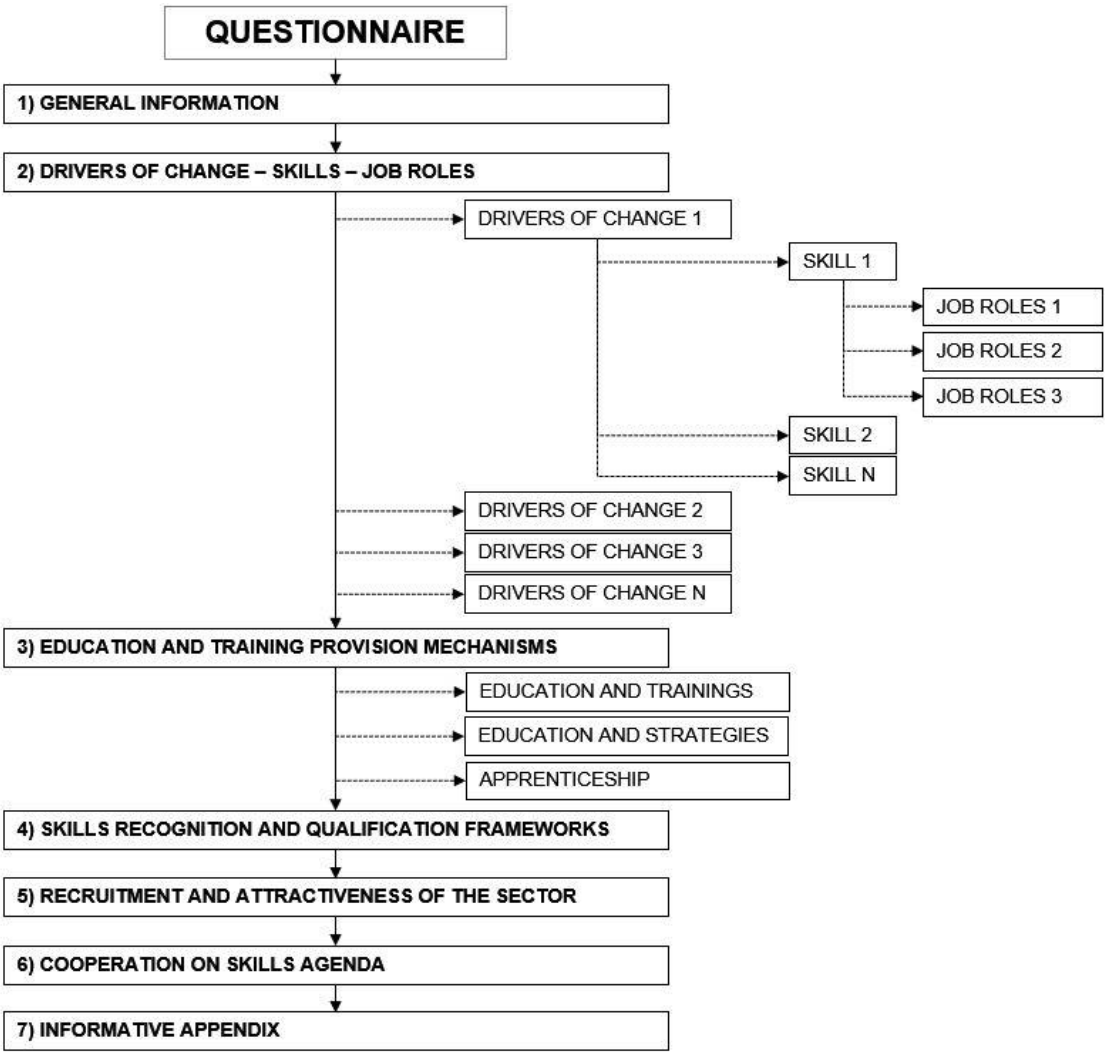

Figure 24: Flow chart questionnaire structure.

In details per each area:

Details of each section of the questionnaire are set out below:

1 **GENERAL INFORMATION**:

This is important to help harmonisation of outcomes. Most questions are not mandatory but completing all questions is strongly advised.

2 **DRIVERS OF CHANGE – SKILLS – JOB ROLES**

- First step: Verify, confirm, add to, or amend the list of proposed Drivers of Change.
- Second step: Indicate which current or emerging skills are likely to be required in the workforce, based on previously identified Drivers of Change.
- Third step: Identify existing Job Roles that will need to evolve in relation to changing skill requirements as a result of the above responses, or new job roles likely to emerge.

3 **VET PROVISION MECHANISMS**:

Understanding current VET mechanisms is identified as an important element of the overall skills strategy. This information will also support the design of and help focus all subsequent WPs'. The section is divided in 3 parts:

- Education and training approach: This enables respondents to identify which training approach is likely to be the most appropriate in the future (both for initial education and continuous training)
- Education and training strategy: Enables respondents to set out their views on the best approach to transfer skills
- Apprenticeships: Captures views on the current and future evolution of apprenticeships serving the automotive sector.

4 **SKILLS RECOGNITION AND QUALIFICATION FRAMEWORKS**:

This section is designed to obtain structured information on the current use of specific Recognition and Qualification frameworks and implications for greater, EU harmonisation (See Figure 25.)

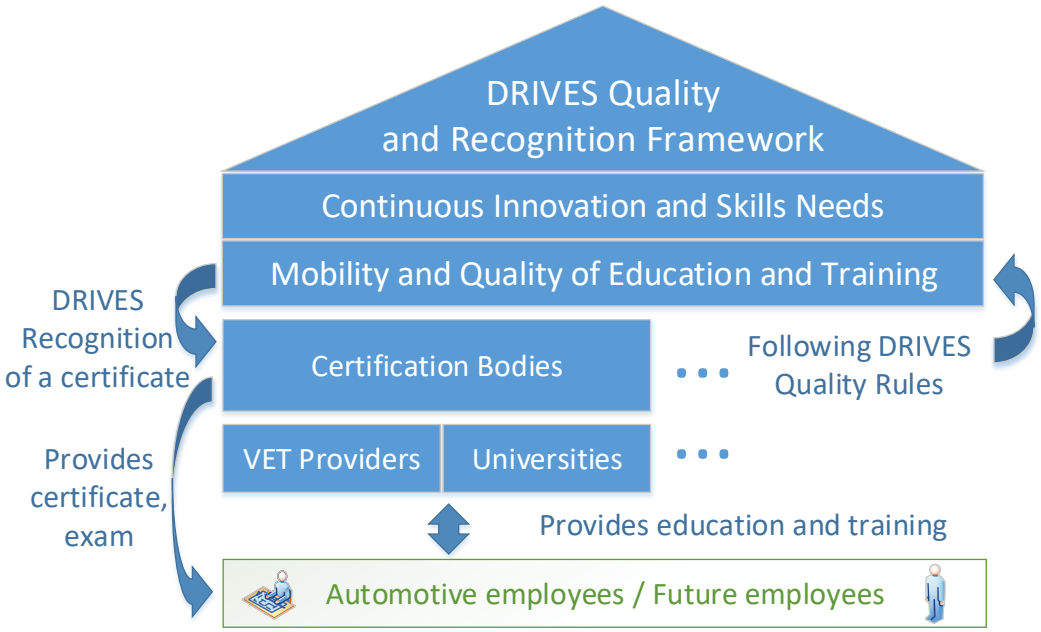

Figure 25: DRIVES SKILLS RECOGNITION AND QUALIFICATION FRAMEWORKS vision".

5 **RECRUITMENT AND ATTRACTIVENESS OF THE SECTOR**:

A number of questions were included in order to capture views on the current attractiveness of the sector and the need to increase the attractiveness for new and talented (young) potential recruits.

6 **COOPERATION ON SKILLS AGENDA**:

It is important for DRIVES partners to develop a constructive, strong and stable relationship with stakeholders across the automotive sector. This section is designed to identify those respondents willing to have further contact with the DRIVES project and is an important aspect of ensuring project sustainability. Replies and feedback from this section will inform the next steps of the project and in particular, the potential development of a permanent working group of willing stakeholders.

7 ORGANISATION AND CONTACT DETAILS:

This section was included in order to obtain valuable information regarding each respondent and support data harmonisation.

7 APPENDIX

7.1 EUROSTAT ANALYSIS OF THE SECTOR

The analysis of the sector has been compiled based on the most relevant EUROSTAT indicators relating to the economic structure, market dynamics and workforce within the 28 EU countries in terms of:

- V11110 Enterprises - number
- V12110 Turnover or gross premiums written - million euro
- V16110 Persons employed - number

The time-period 2012 to 2016 has been used for sector aggregation and the period 2014 to 2016 in relation to each NACE code analysed as part of the project.

NACE[64] (Nomenclature of Economic Activities) is the European statistical classification of economic activities. Statistics produced based on NACE are comparable at European level and, in general, at world level in line with the United Nations' International Standard Industrial Classification (ISIC). The DRIVES partners agreed to define the scope of the project on the basis of the following NACE rev. 2 codes:

C29.1 - Manufacture of motor vehicles

C29.2 - Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers

C29.3 - Manufacture of parts and accessories for motor vehicles

C22.1.1 - Manufacture of rubber tyres and tubes; re-treading and rebuilding of rubber tyres

G45.1 - Sale of motor vehicles

G45.2 - Maintenance and repair of motor vehicles

G45.3 - Sale of motor vehicle parts and accessories

ETRMA has provided a vision of the sector based on its booklets from 2014 to 2016 at:

- http://www.etrma.org/uploads/Modules/Documentsmanager/20180329---statistics-booklet-2017---alternative-rubber-section-final-web.pdf
- http://www.etrma.org/uploads/Modules/Documentsmanager/20161208---statistics-booklet-2016-final5.pdf

ACEA suggests viewing their statistics section at: https://www.acea.be/statistics

64 *https://ec.europa.eu/eurostat/web/nace-rev2/overview*

CLEPA indicate that a more detailed analysis of the sector can be found on their web site at: https://clepa.eu/.

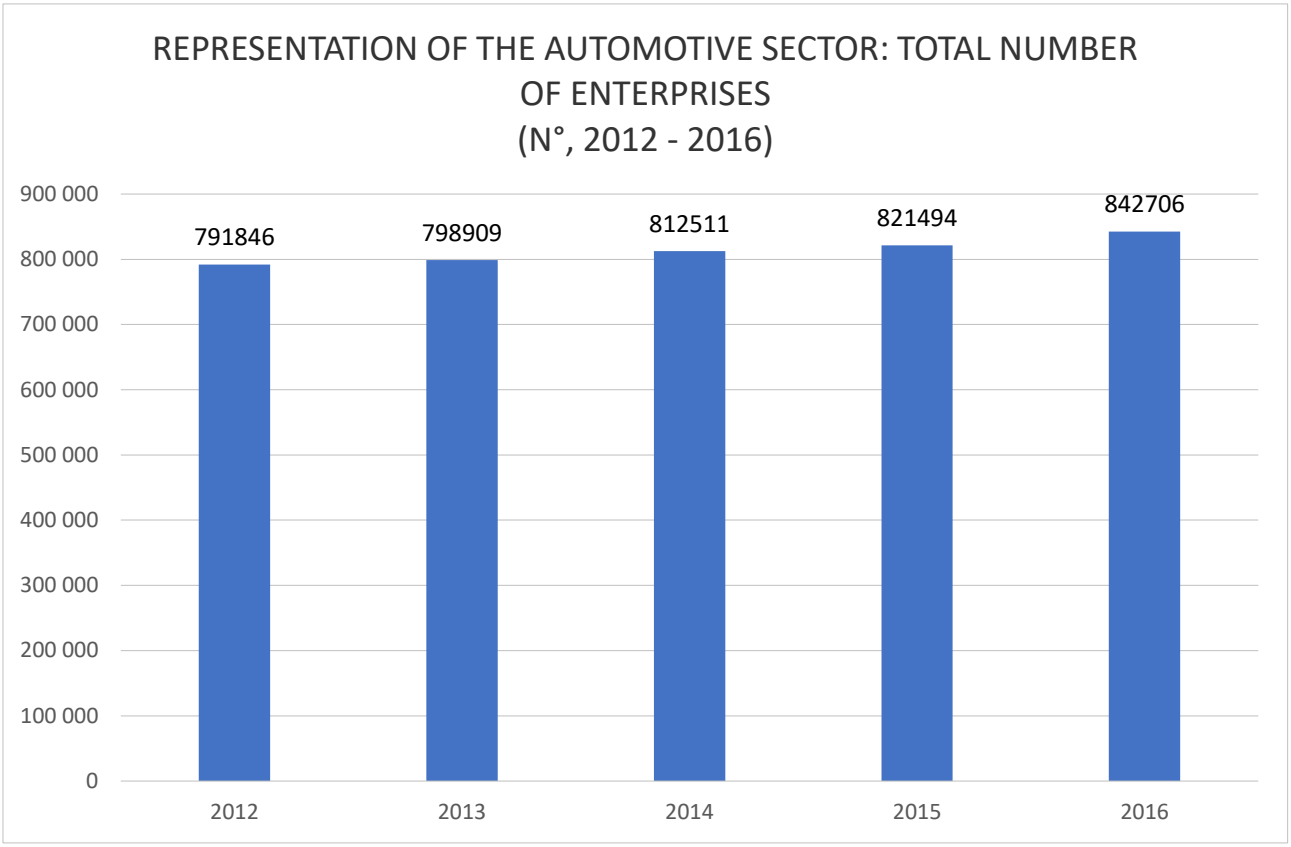

Figure 26: Total number of enterprises

Based on Eurostat data, the sector comprises around 840,000 enterprises. Over the last 5 years there has been a net increase of about 50.000 companies in the sector.

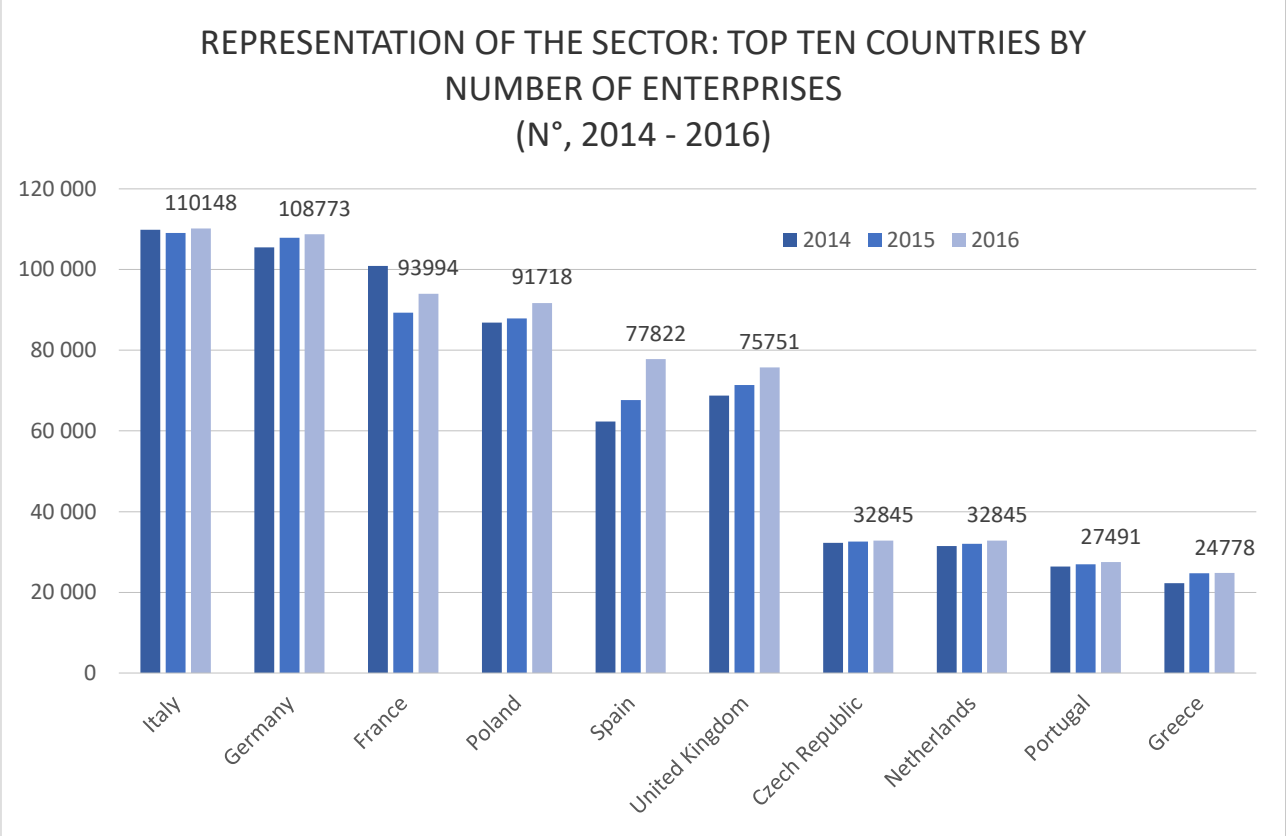

Figure 27: Top ten countries by number of enterprises

Italy and Germany are the most important countries in terms of the number of enterprises in the sector. The top 6 countries account for about two thirds of all automotive enterprises (approximately 66%), with all six having a broadly comparable number. In terms of changing numbers within the top 6 countries over the period 2014-16, the UK and Spain performed relatively well with consistent increases over this period. By contrast France experienced a net loss between 2014 and 2015 with a gain during 2015-16 but not enough to counteract the loss in the previous year.

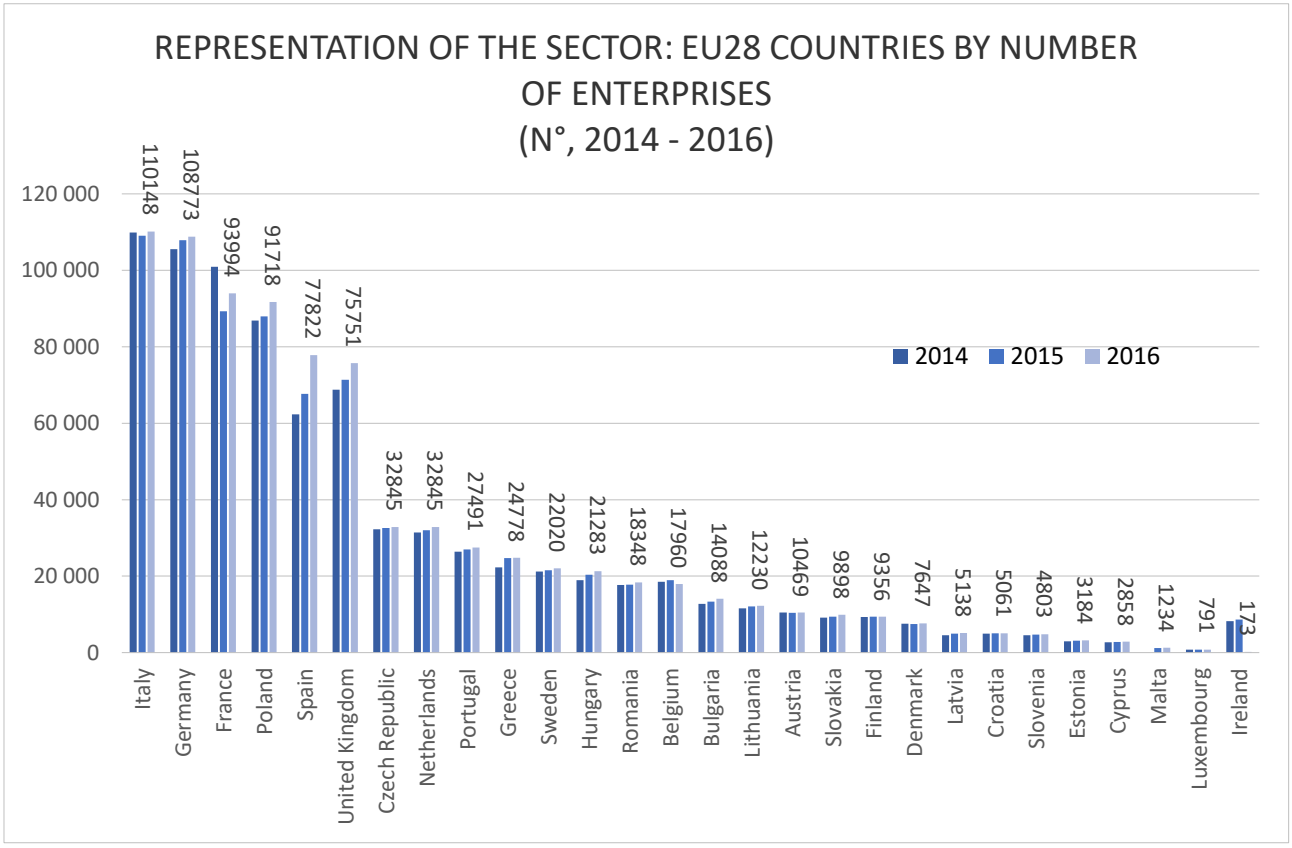

Figure 28: EU28 countries by number of enterprises

Excluding the TOP 6 countries (IT, DE, FR, PL, ES and UK) measured in terms of the number of automotive enterprises, the remaining EU countries show more or less stable behaviour in relation to the overall number of enterprises over the period 2014-16. The numbers of enterprises is relatively concentrated within that the TOP 6 countries, with more than double the number of enterprises within the UK (sixth position) by comparison with the Czech Republic (seventh position).

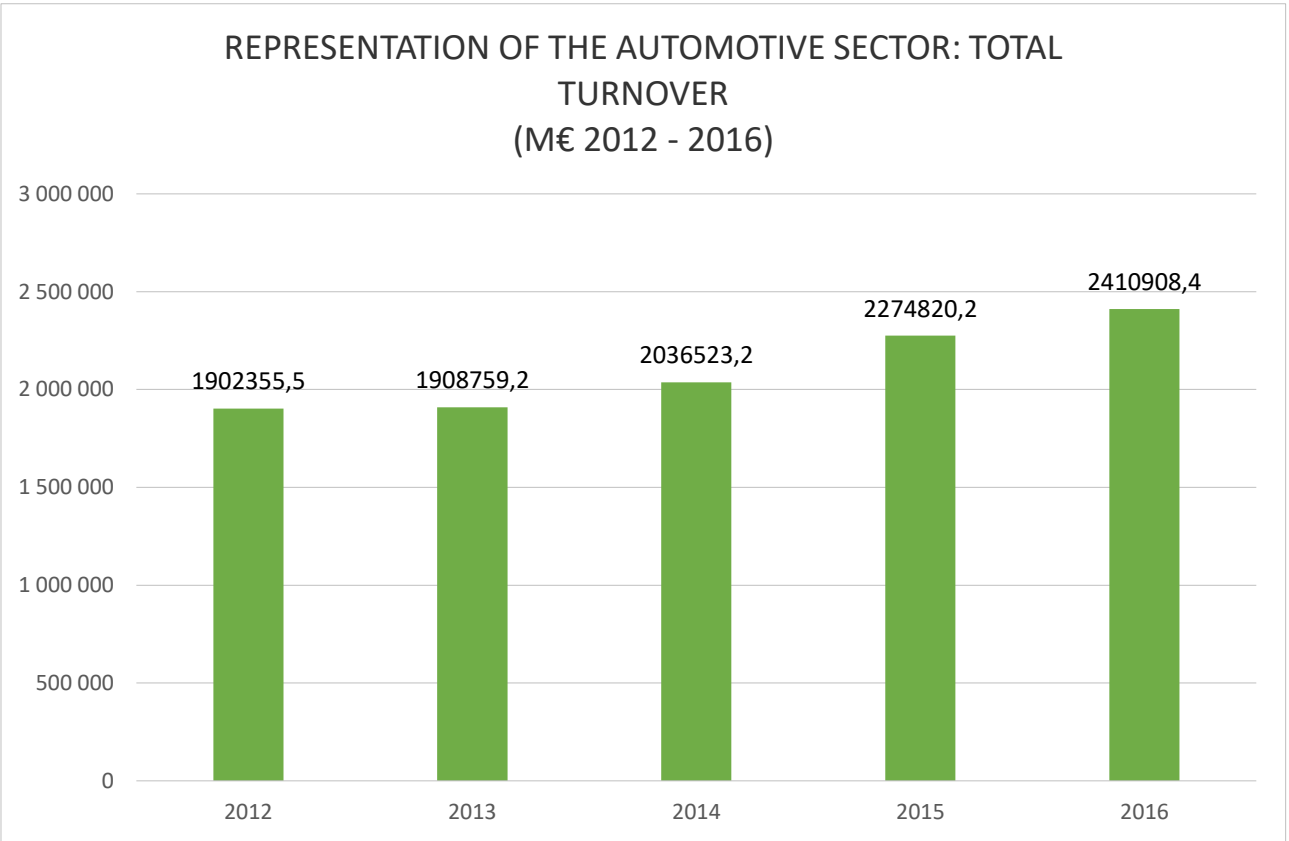

Figure 29: Total turnover

Figure 29 illustrates trends in European automotive sector turnover over the period 2012 – 2016 period. After almost no change over the period 2012 and 2013 the sector shows a steady upward trend in the turnover for the remainder of the period, with a net turnover gain over the whole period between 2012 to 2016 of more than 26%.

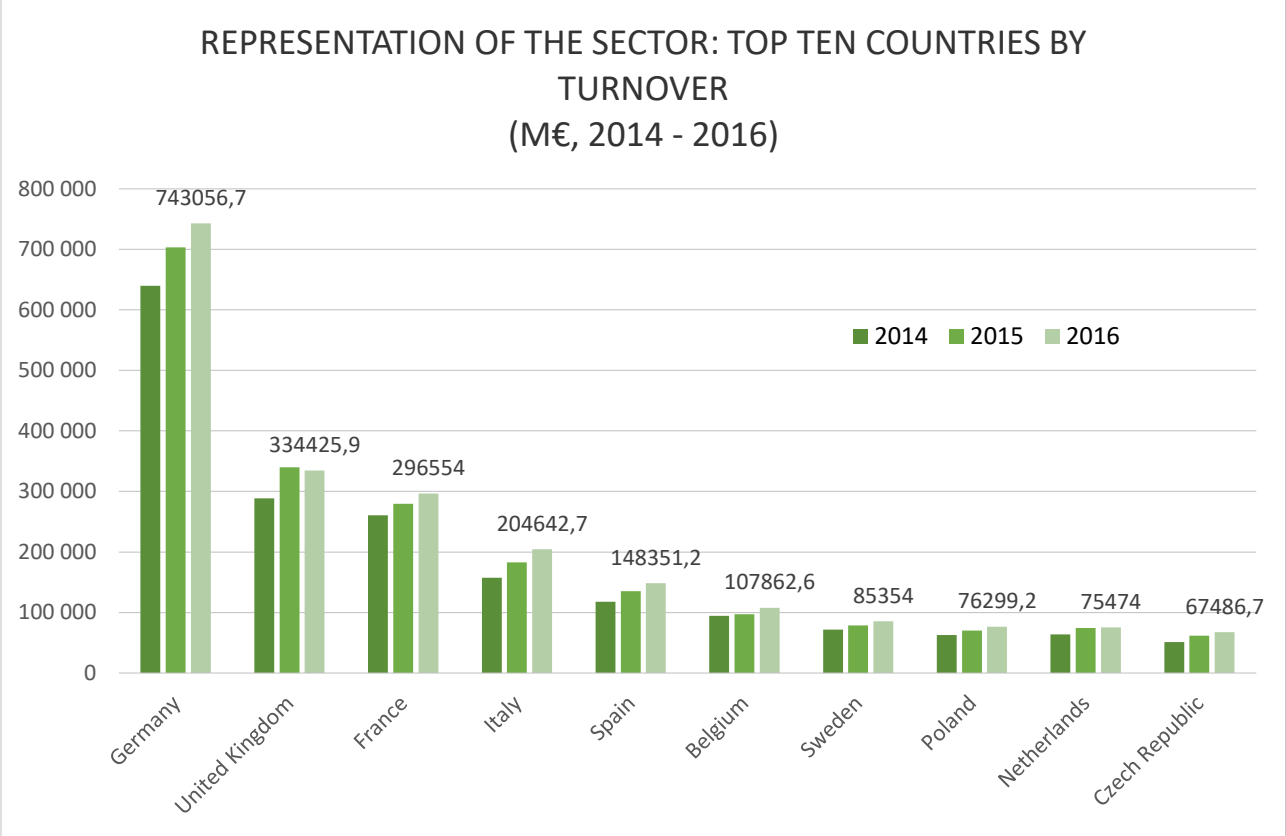

Figure 30: Top ten countries by turnover

The geographical distribution of turnover does not completely mirror the geographical distribution of enterprises. In terms of turnover, Germany is the leading country, accounting for more than 30% of the entire sector in 2016. Overall, the Top 10 countries account for more than 88% of the sector turnover and the TOP 6 countries, 76%. The UK, France, Italy and Spain have a comparable turnover, even if less than half that of Germany. Although measured in terms of the number of enterprises, trends in the French automotive sector were uneven. Figure 30 indicates that in terms of turnover a continuous upward trend was evident over the period 2014-16. Based on available evidence, turnover growth continued through 2017 in Germany. According to VDA[65], the automotive industry in Germany can look back on a successful 2017: automotive facilities earned 422.8 billion euros and pushed their turnover up by more than 4%. Particularly strong growth was seen in relation to export earnings (+6 percent), which accounted for a total of 271.7 billion euros. Overall growth in turnover within the euro zone in 2014-2016 was particularly significant (+9 percent), boosted by the market trends in Europe. Turnover accounted for by domestic customers also increased (+2 percent) over this period accounting for 151.0 billion euros.

65 https://www.vda.de/en/services/facts-and-figures/facts-and-figures-overview.html

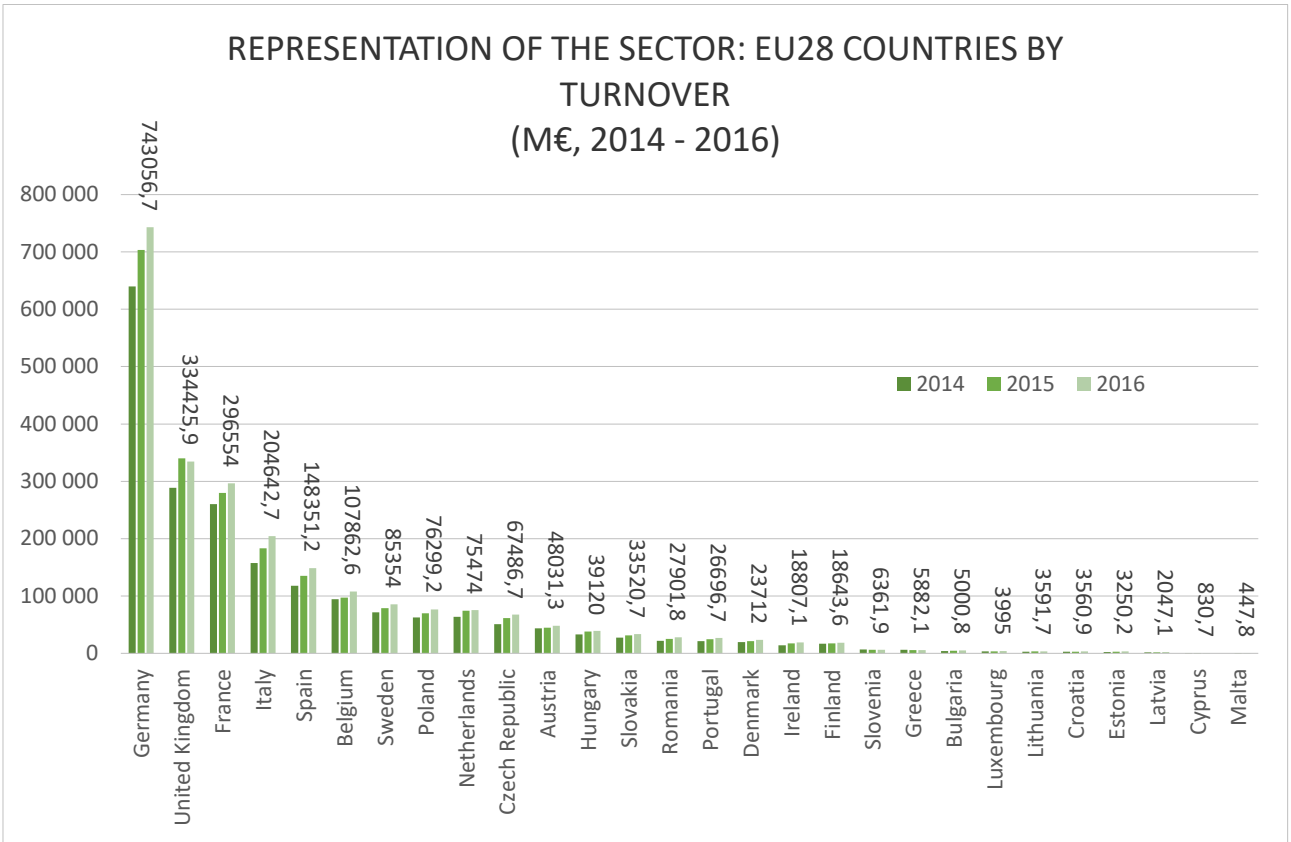

Figure 31: EU28 countries by turnover

Figure 31 highlights turnover trends across the EU28 confirming the pre-dominance of Germany in relation to the contribution of turnover by value; from Spain, ranked at 5th, to Finland ranked at 18th position, all the countries are almost comparable.

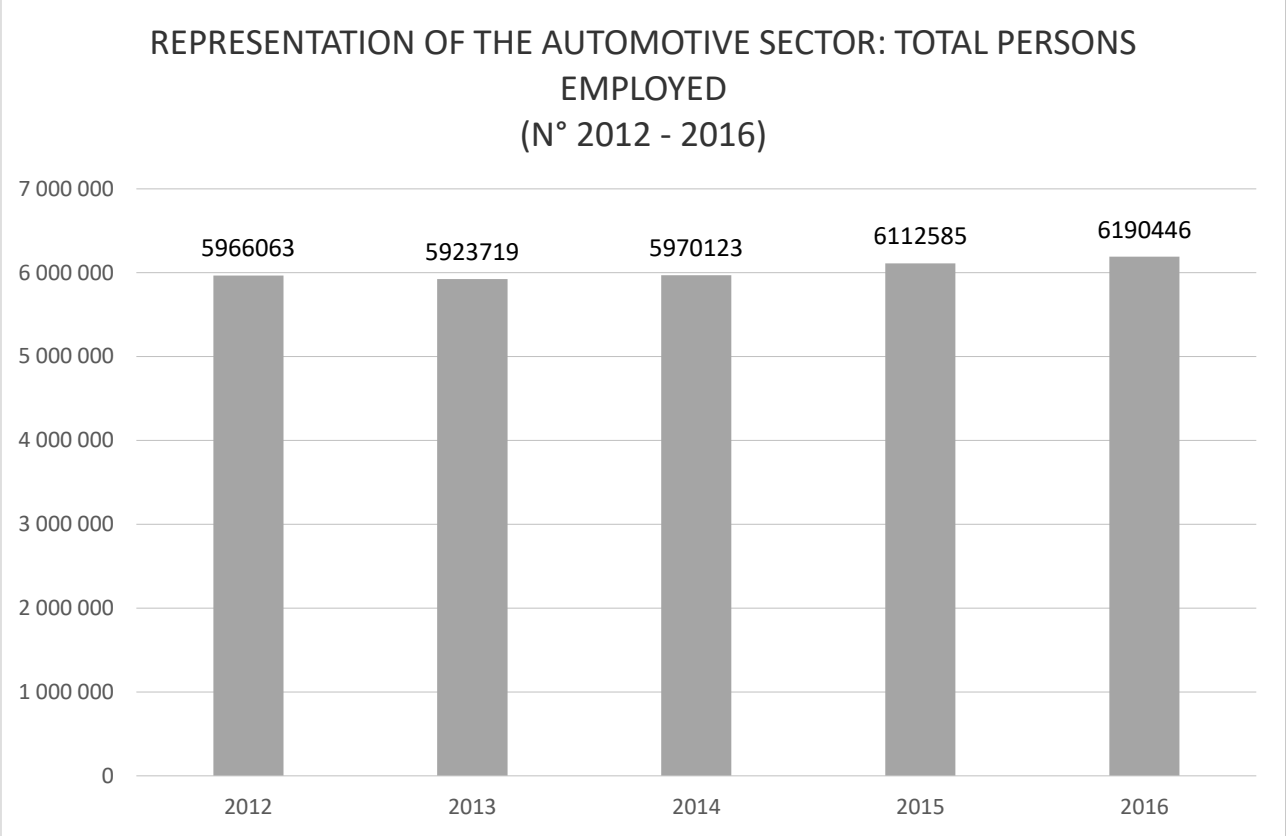

Figure 32: Total persons employed

Figure 32 highlights employment trends for the EU automotive sector as a whole over the period 2012 to 2016. The figure points to a slight net increase in numbers employed over the whole period of +3,7%, with a steady increase over the period 2014-16, following a slight net decrease during 2012-13.

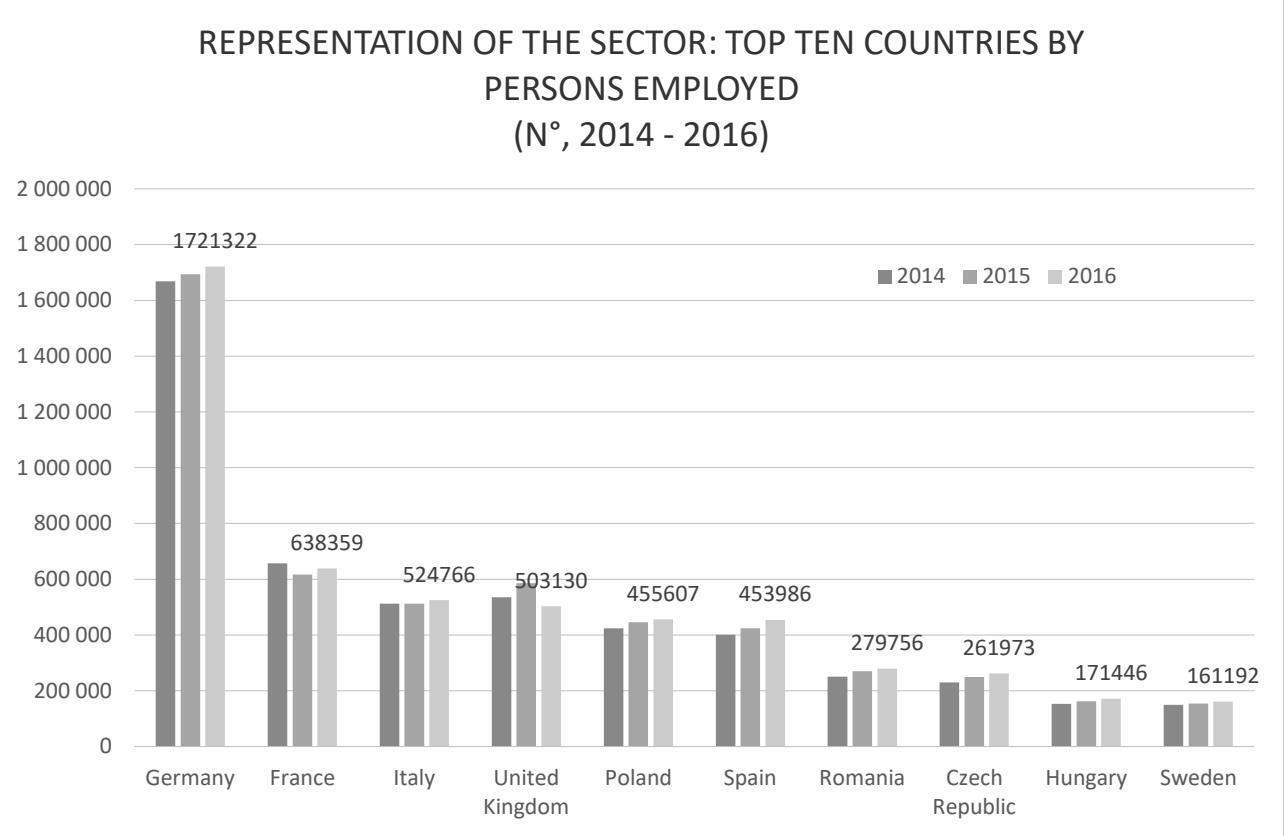

Figure 33: Top ten countries by persons employed

Analysis of the top ten EU countries by numbers employed in the automotive sector again underlines the importance of Germany, with a large gap between Germany and France ranked second on this basis. The top 6 countries measured on this basis account for about 70% of all EU automotive sector employment. The analysis highlights significant variations in employment trends over the period 2014-16. While Germany (first place) and Poland (fifth place) have a positive upward trend in absolute terms over the whole of this period (A net increase of +7,5% in Poland and +3,2 in Germany), France (second place) experienced a net decrease of -6% between 2014 and 2015, with a net gain between 2015 and 2016 but not enough to counteract previous losses (A net loss of -2.9% was evident over the whole period 2014-2016). This compares with Italy (third place) experiencing a modest net increase of +2,4% over the whole period. The UK (fourth place) experienced significant net losses over the period 2015-2016 resulting in a net contraction over the whole period 2014-2016 of -6% and a move from third to fourth place in terms of the overall ranking by employment size. Taking the whole period 2014-2016, significant percentage employment increases were evident in Spain (+13%), Romania (+11,4%) and Czech Republic (+13,7%).

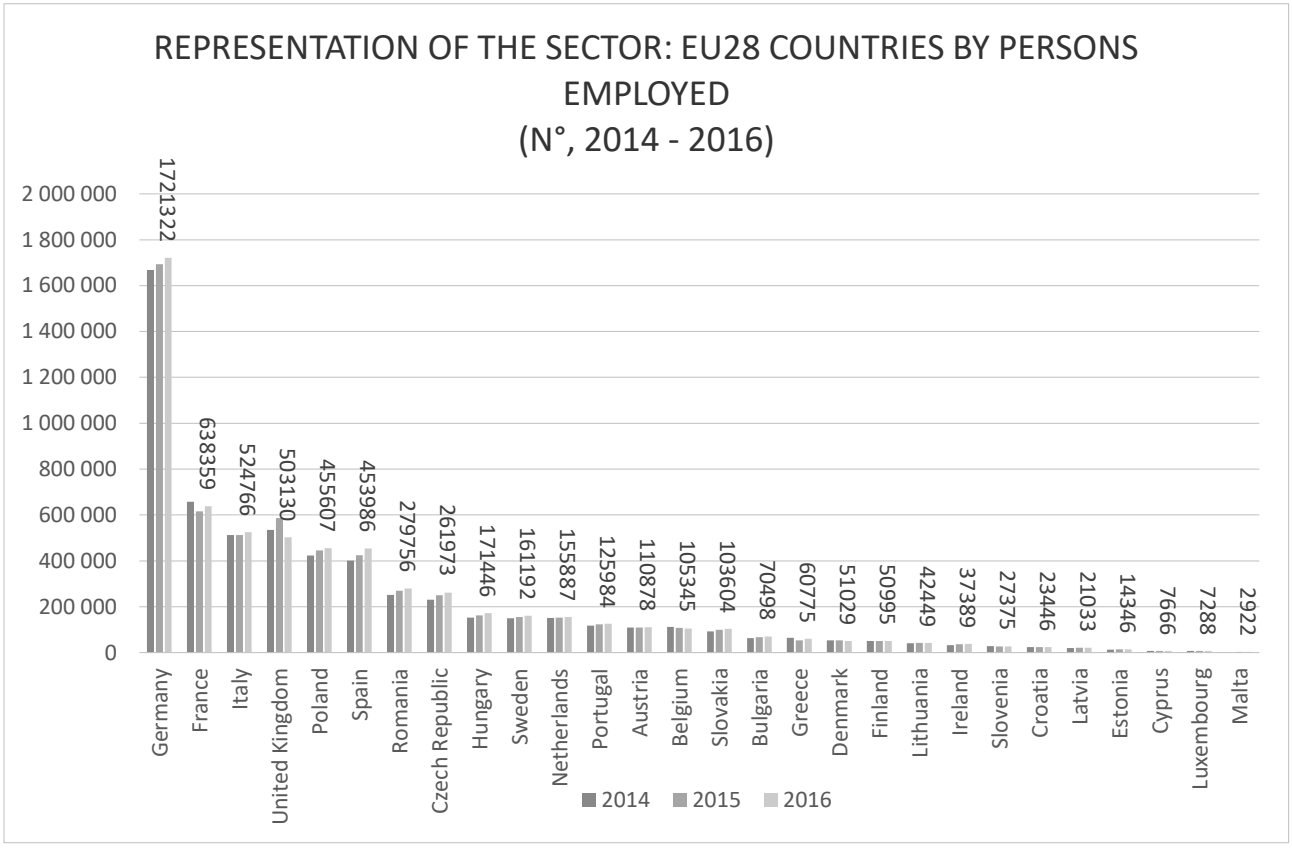

Figure 34: EU28 countries by persons employed

Analysis of employment figures for the EU28 countries is set out in Figure 34. The analysis highlights 4 macro-groups, these being Germany as the first group, which is 3 times bigger than the second group comprising France, Italy, UK, Poland and Spain; the third group measured by numbers employed comprises Romania and the Czech Republic, with the fourth group comprising the remainder of the EU28 countries.

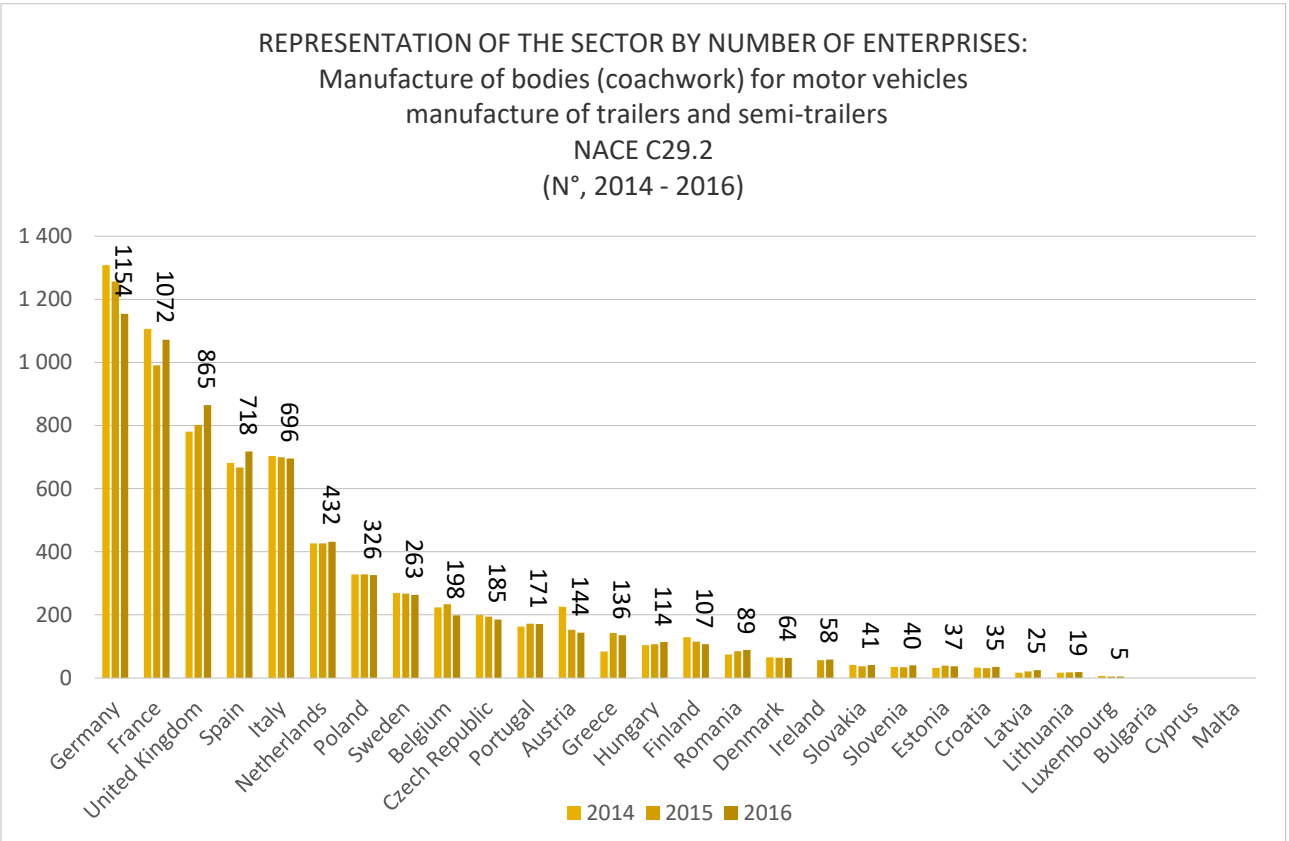

Figure 35: NUMBER OF ENTERPRISES: MANUFACTURE OF BODIES (COACHWORK) FOR MOTOR VEHICLES, MANUFACTURE OF TRAILERS AND SEMI-TRAILERS (NACE C29.2)

Looking now specifically at the sub-sector NACE code C29.2, analysis by number of enterprises indicates that the TOP 6 countries account for 71% of all enterprises in the sub-sector and can be split into two groups: First, Germany and France (32% of all enterprises), and UK, Spain Italy and Netherland (39% of all enterprises). Trends in terms of the number of enterprises varies somewhat between the TOP 6 countries over the period 2014 to 2016. Germany experienced a significant decrease of -12% over this period, while both France and Spain experienced initial decreases followed by upturns. In the case of France, the net change over the whole period 2014-16 was a net decrease of -3%, with a net increase in Spain of +5,4. Over this whole period a marginal net decrease of -1% was experienced in Italy.

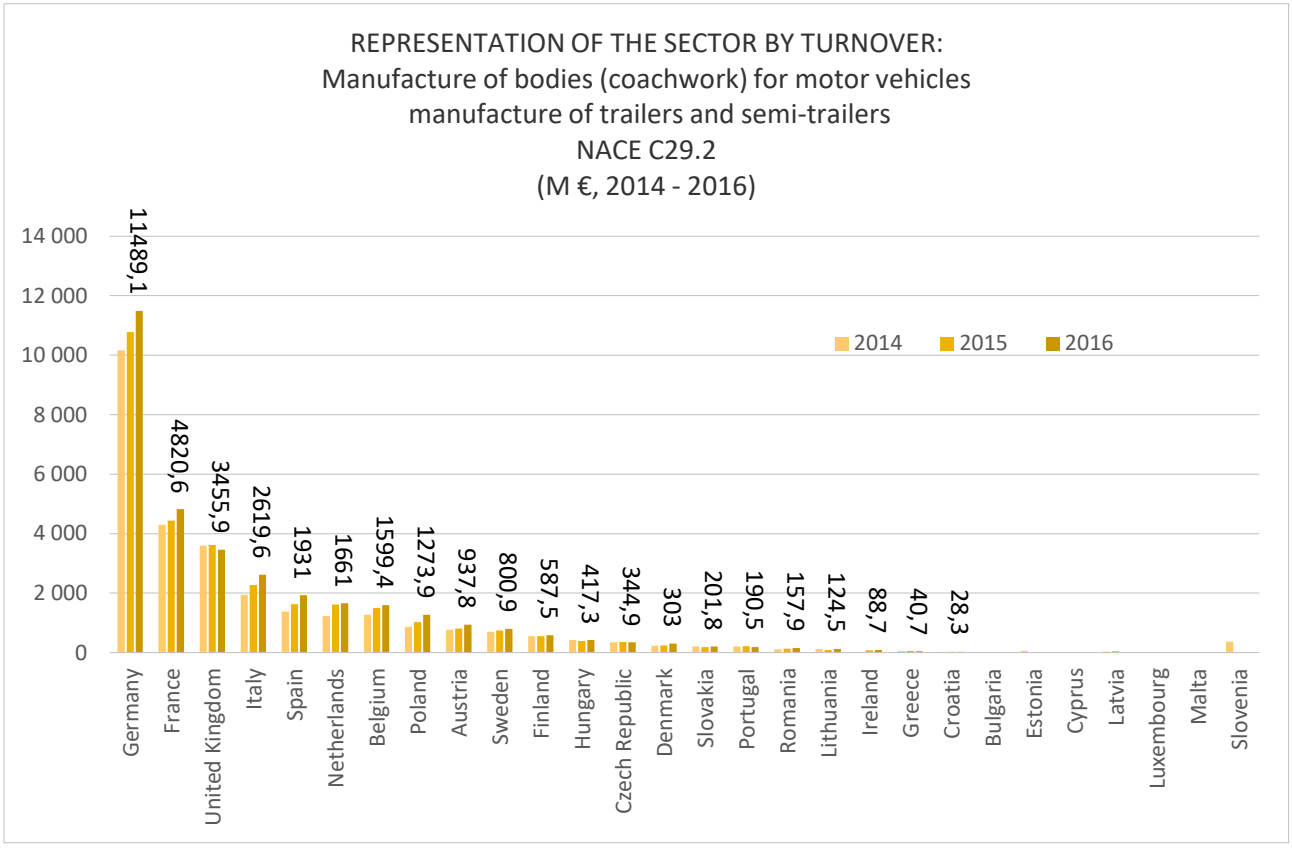

Figure 36: TURNOVER: MANUFACTURE OF BODIES (COACHWORK) FOR MOTOR VEHICLES, MANUFACTURE OF TRAILERS AND SEMI-TRAILERS (NACE C29.2)

Analysis of the geographical distribution of companies by turnover in NACE C29.2 indicates that the TOP 6 countries mirror those when measured by number of enterprises. However, when measured by turnover, Germany (first) is about 3 times the size of France (second). With the exception of the UK, which experienced a net decline of -4%, all the other TOP countries experienced a positive upward trend during 2014, 2015 and 2016.

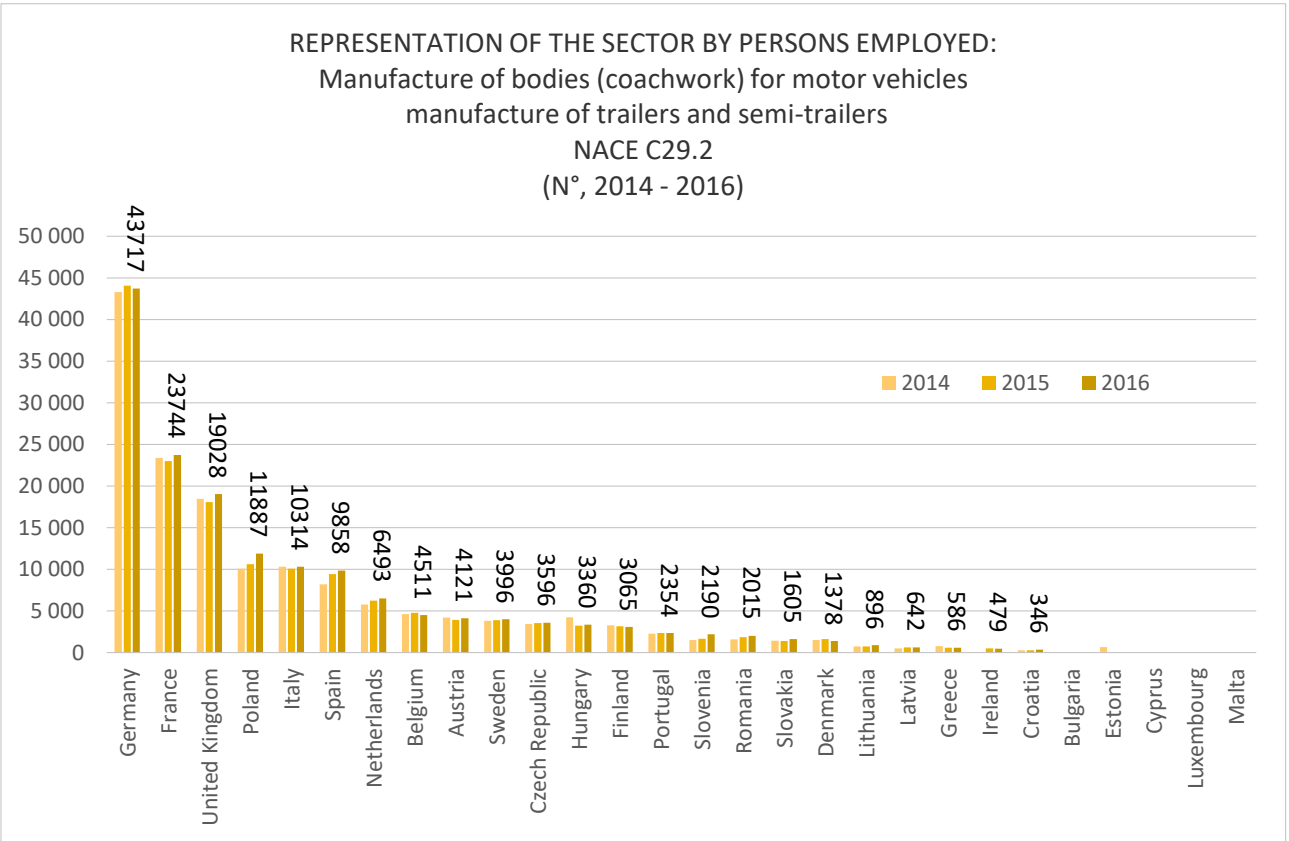

Figure 37: PERSONS EMPLOYED: MANUFACTURE OF BODIES (COACHWORK) FOR MOTOR VEHICLES, MANUFACTURE OF TRAILERS AND SEMI-TRAILERS (NACE C29.2)

Measured by numbers employed, again, Germany is the most important country in relation to NACE code C29.2, with a significant gap evident between first and second place (France). The TOP 6 countries account for 74% of all employment relating to this sub-sector. Trends over the period 2014-16 vary somewhat, although all have experienced a net gain over the whole period: Germany +1%, France +1,5%, K +3,2%, Poland +18,1% and Italy +0,2%.

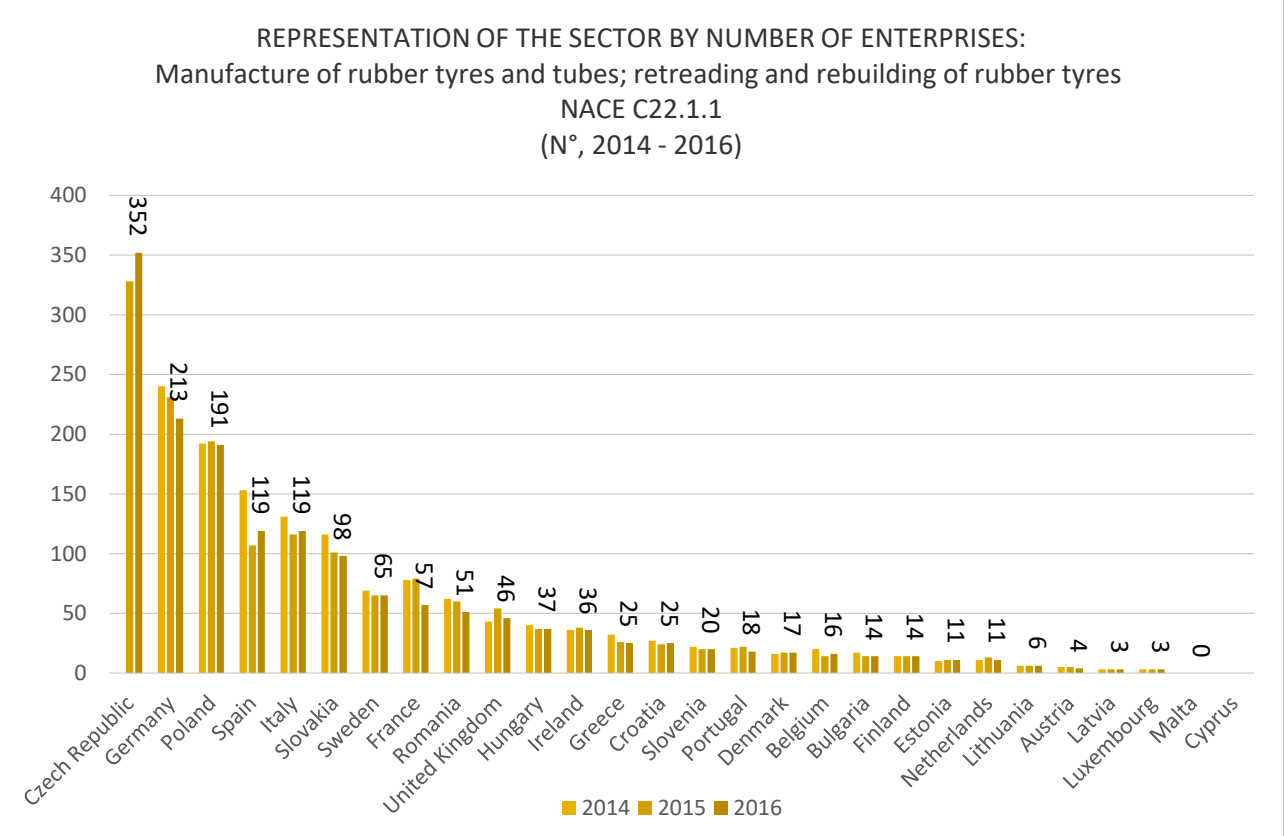

Figure 38: NUMBER OF ENTERPRISES: MANUFACTURE OF RUBBER TYRES AND TUBES; RETREADING AND REBUILDING OF RUBBER TYRES (NACE C22.1.1)

In relation to this NACE sub-sector C22.1.1, the Czech Republic is ranked first measured by the number of enterprises, with an increase between 2015 and 2016 of +7,3%[66].

The TOP 6 countries measured on this basis account for 70% of all enterprises in this NACE sub-sector. With the exception of the Czech Republic all have experienced net losses over the period 2014-2016: Germany -11,3%, Poland -0,5%, Spain -22%, Italy -9,2% and Slovakia -15,5%.

66 *Eurostat values not available for 2014*

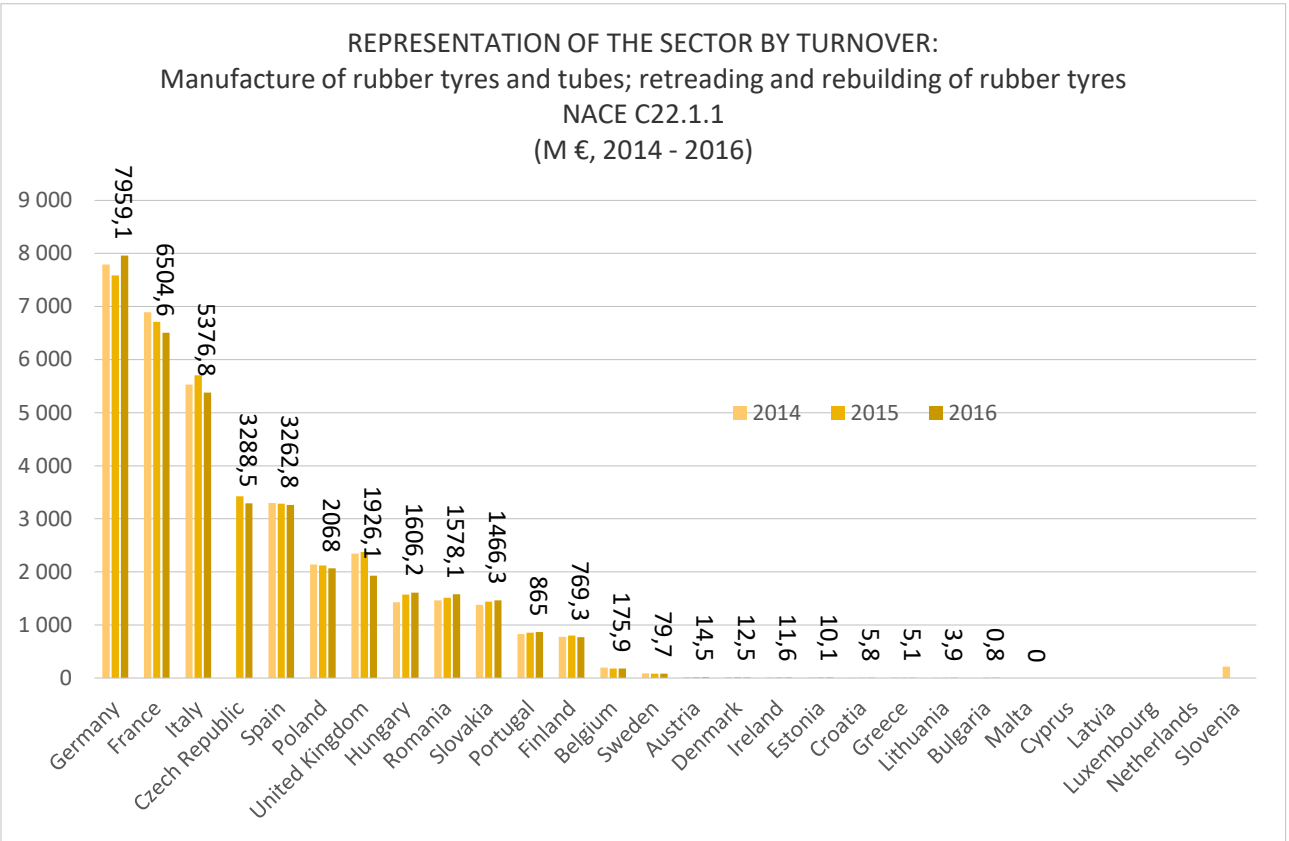

Figure 39: TURNOVER: MANUFACTURE OF RUBBER TYRES AND TUBES; RETREADING AND REBUILDING OF RUBBER TYRES (NACE C22.1.1)

In relation to NACE code C22.1.1, Germany, France and Italy are ranked as the top three countries in terms of turnover. All three countries experienced different trends over the period 2014-16. While Germany experienced a decrease in turnover between 2014 and 2015, but an increase between 2015-16, France experienced a year on year decrease over this period, and Italy experienced an initial increase followed by a decline. Taking the whole period 2014-16, Germany experienced a net increase, while both France and Italy experienced a net decline. However, the steepest net decline over this period was experienced in the UK (-18%).

Turnover trends in relation to NACE code C22.1.1 are set out in figure 39.

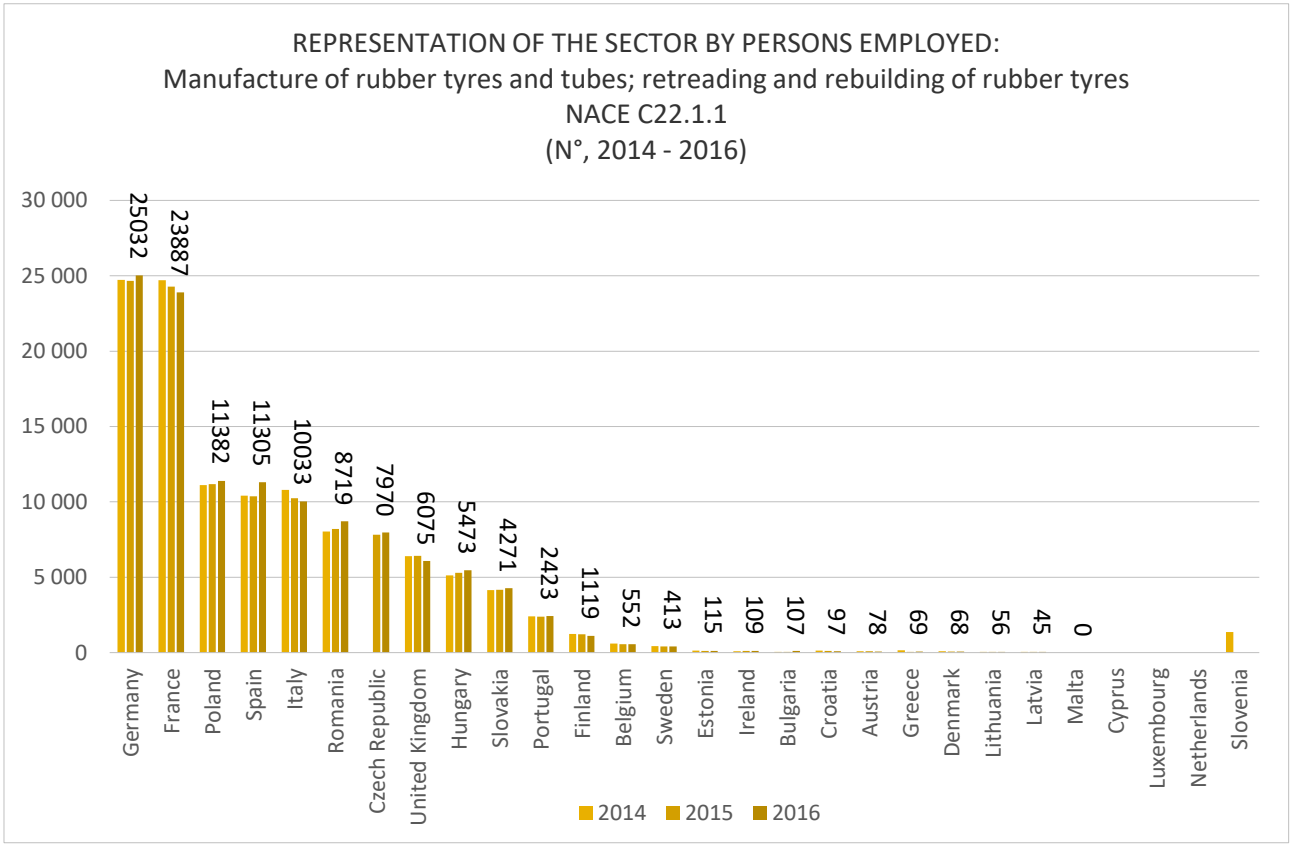

Figure 40: PERSONS EMPLOYED: MANUFACTURE OF RUBBER TYRES AND TUBES; RETREADING AND REBUILDING OF RUBBER TYRES (NACE C22.1.1)

In terms of numbers employed within NACE code C22.1.1, figure 40 indicates that Germany and France are ranked first and second respectively in relation to EU28 countries, accounting for more than 40% of all employed in this sub-sector. The TOP 6 countries comprise 76% of total employment. Although there are distinct annual variations by country, over the period 2014-16, taking the whole period as a whole, in relation to the TOP10 EU28 countries, only France, Italy and UK experienced a net loss in numbers employed, of -3,3%, -7,1% and -5% respectively. Using Eurostat data it is not possible to analyse trends amongst all EU28 countries.

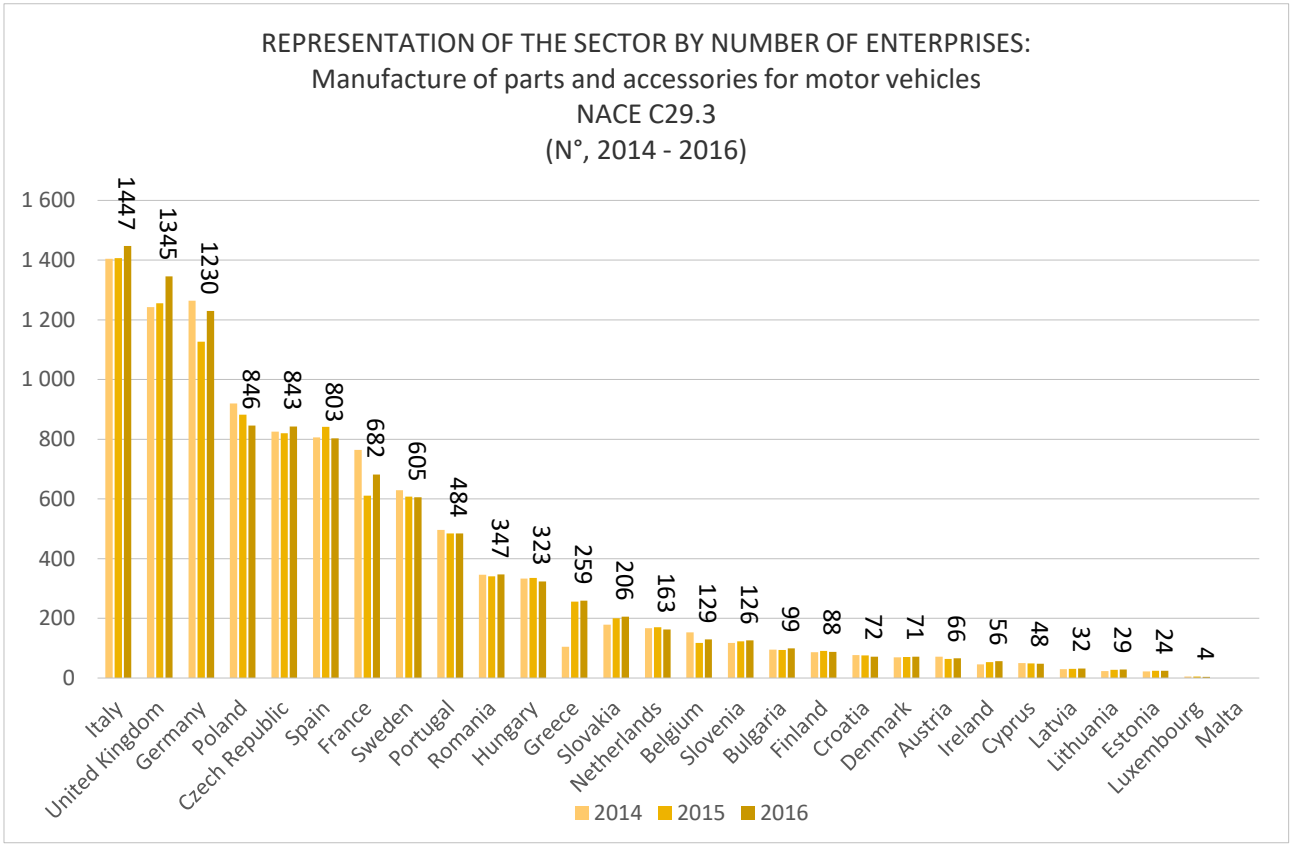

Figure 41: NUMBER OF ENTERPRISES: MANUFACTURE OF PARTS AND ACCESSORIES FOR MOTOR VEHICLES (NACE C29.3)

In relation to NACE code C29.3 analysis of the geographical distribution of enterprises indicates that Italy, UK and Germany are ranked as the TOP3 countries within the EU28, accounting for almost 40% of all enterprises. Increased numbers of enterprises over the period 2015-16 are evident in relation to all three of these countries, although, unlike both Italy and the UK, Germany experienced a net decline in numbers of enterprises over the whole period 2014-16 of -2,7%.

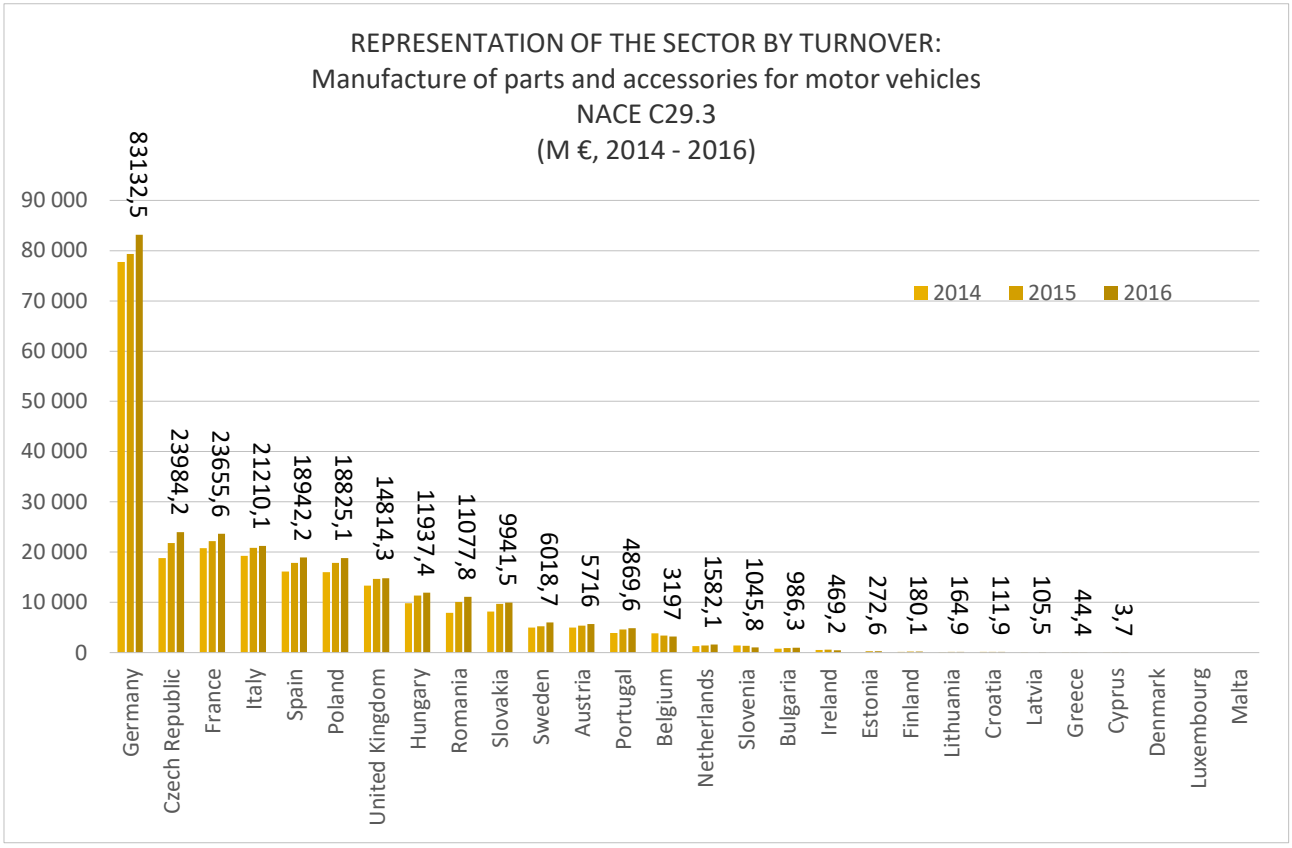

Figure 42: TURNOVER: MANUFACTURE OF PARTS AND ACCESSORIES FOR MOTOR VEHICLES (NACE C29.3)

Again, in relation to NACE sector C29.3, in relation to turnover, Germany is almost 4 times larger than the Czech Republic (ranked second on this basis). Over the period 2014-2016 there is a positive upward trend evident across all countries falling within the TOP 10 based on turnover.

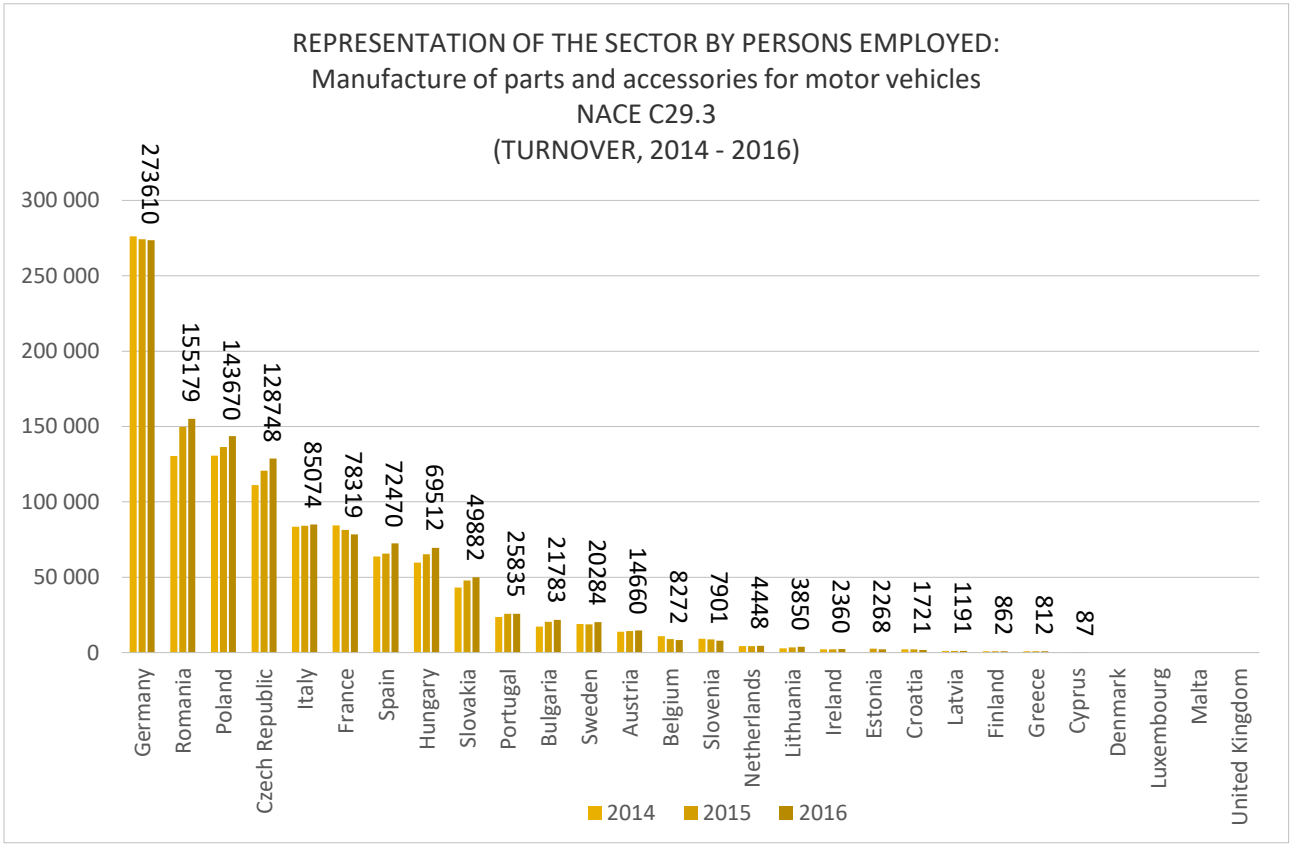

Figure 43: PERSONS EMPLOYED: MANUFACTURE OF PARTS AND ACCESSORIES FOR MOTOR VEHICLES (NACE C29.3)

Analysing the geographical distribution of employment in relation to NACE C29.3, it is evident that Germany maintains number one ranking. The sub-sector can be split in to four main groups of countries based on numbers employed: Germany (with 23% of employment within the EU28), Romania, Poland and Czech Republic (collectively accounting for 36% of EU28 employment), Italy, France, Spain, Hungary and Slovakia (collectively accounting for 30% of the EU28 total), all other EU28 countries.

Net employment change over the period 2014 to 2016 is positive, with the exception of Germany which experienced a marginal net employment decline of -1%

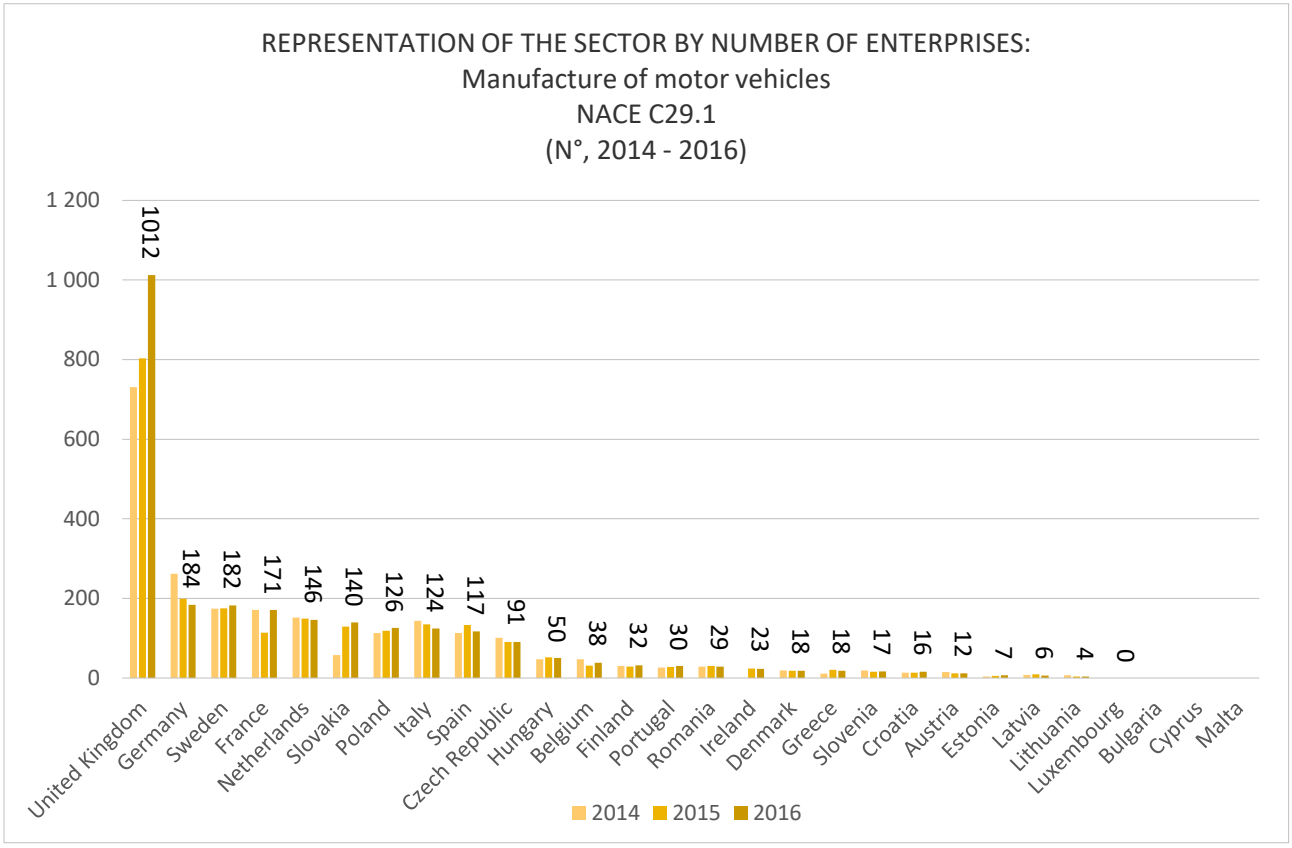

Figure 44: NUMBER OF ENTERPRISES: MANUFACTURE OF MOTOR VEHICLES (NACE C29.1)

In relation to NACE code C29.1 the UK stands out and is ranked first in relation to the number of enterprises, with 40% of the EU28 total.

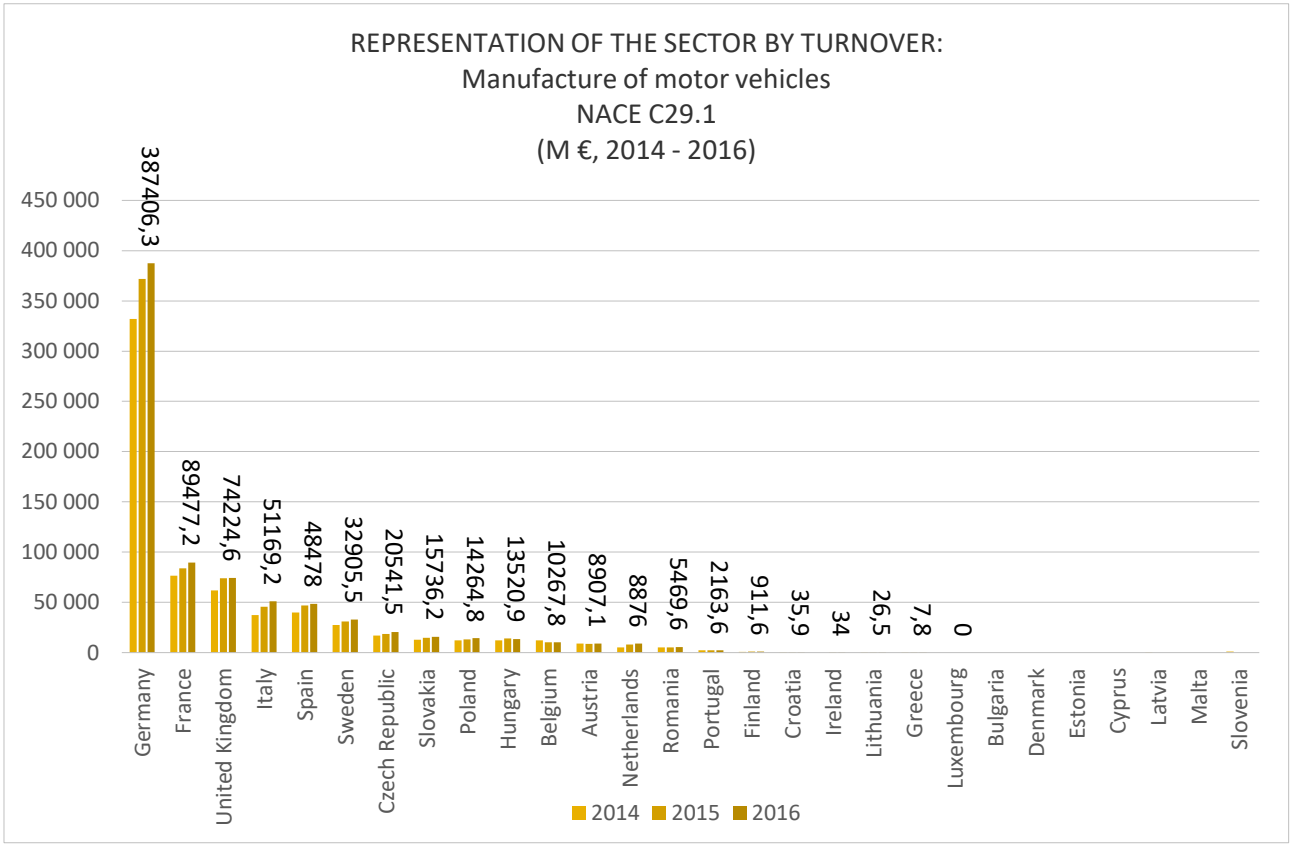

Figure 45: TURNOVER: MANUFACTURE OF MOTOR VEHICLES (NACE C29.1)

Analysis of turnover for this sub-sector indicates Germany is ranked first within the EU28, accounting for 50% of total turnover. The TOP 6 EU28 countries account for 87% of total turnover in the sub-sector.

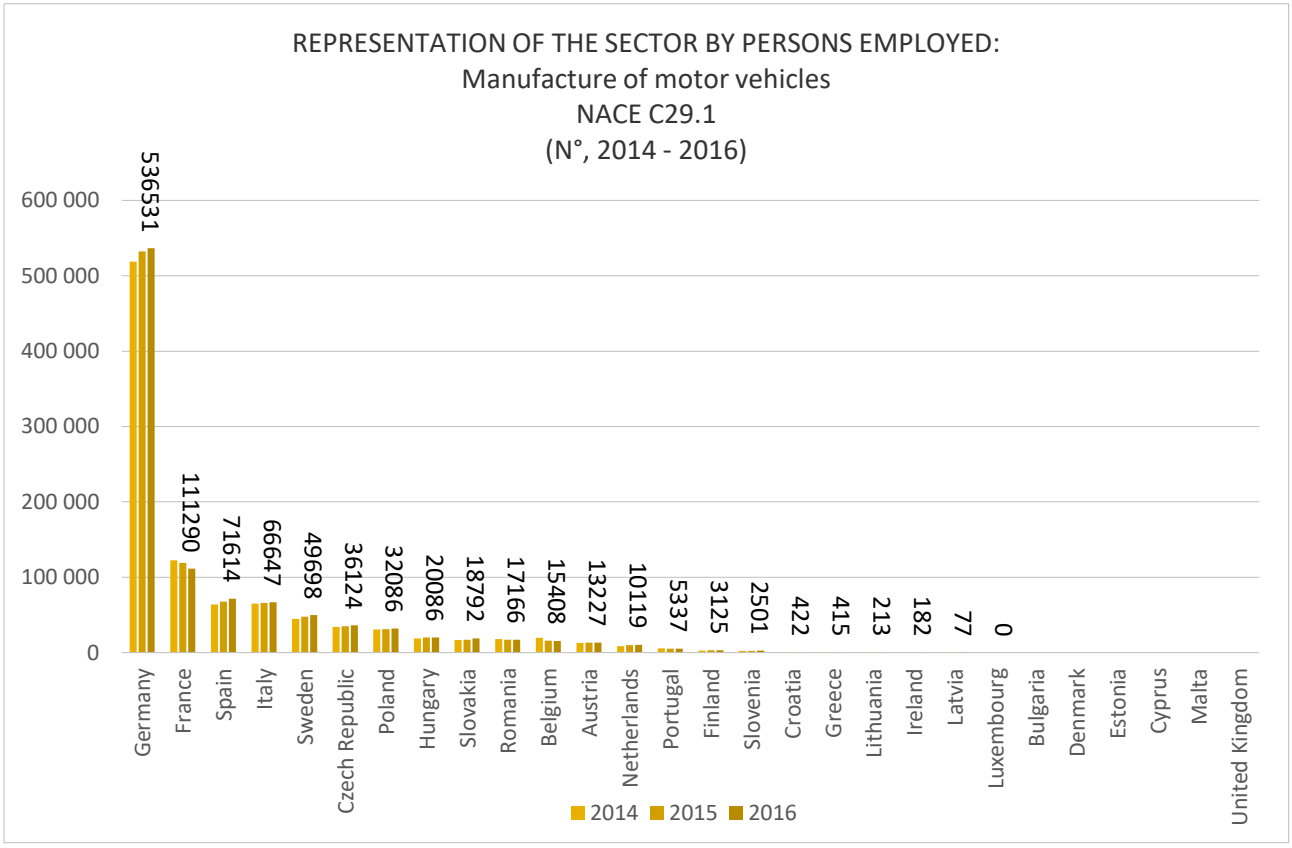

Figure 46: PERSONS EMPLOYED: MANUFACTURE OF MOTOR VEHICLES (NACE C29.1)

As is the case with turnover, Germany is ranked first in relation to numbers employed within the EU28 NACE C29.1 sub-sector, accounting for more than half of all employment within these countries. The top 6 EU28 countries in the sub-sector account for about 86% of all employment. Over the period 2014-2016 net employment has remained fairly stable in all these countries with the exception of Germany that experienced a net increase of +3,5% over this period (in terms of absolute numbers this represents a net increase of about 18.000 employees in 3 years), Spain – a net increase of +12,6% (a net increase of about 8.000 employees) while in France numbers employed fell by -9,2% (with a net loss of about 11.000 employees).

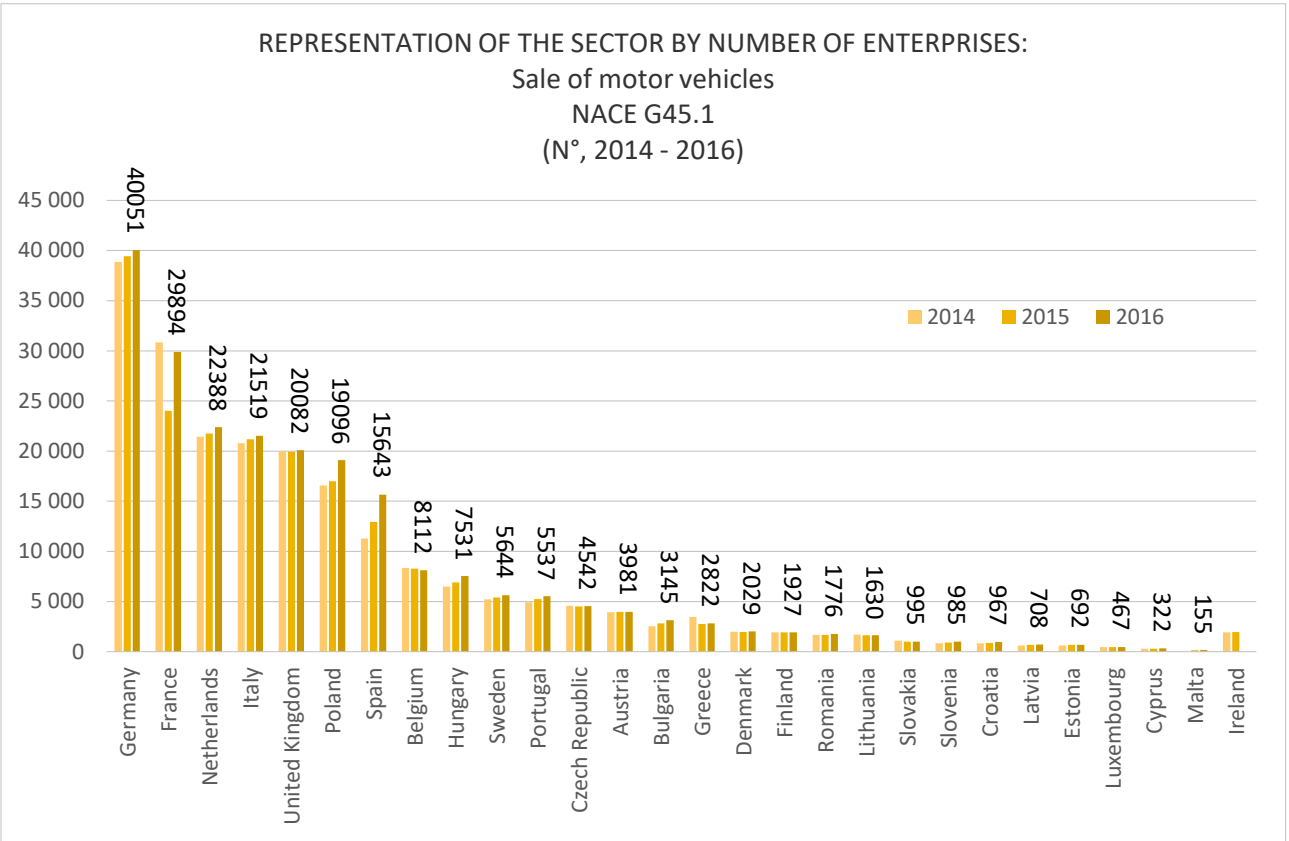

Figure 47: NUMBER OF ENTERPRISES: SALE OF MOTOR VEHICLES (NACE G45.1)

In relation to NACE code G45.1, with the exception of France, the Top 6 EU28 countries experienced an upward trend in terms of numbers of enterprises for the period 2014-2016. In the case of France, although numbers of enterprises increased over the period 2015-16, a net decline of -3% was evident taking the whole period 2014-16. 70% of all enterprises in this NACE code are located within the top 6 EU28 countries.

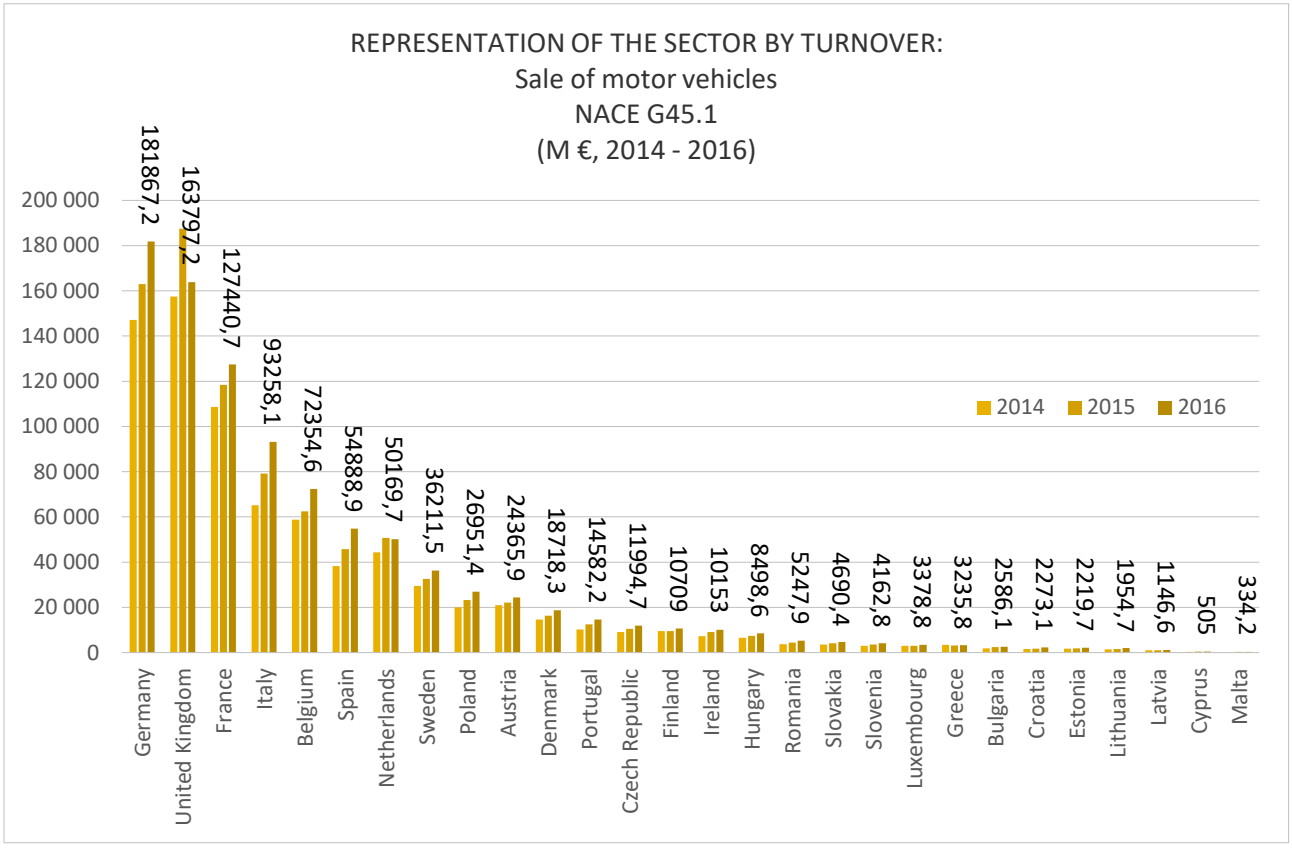

Figure 48: TURNOVER: SALE OF MOTOR VEHICLES (NACE G45.1)

In relation to turnover relating to NACE code G45.1, most of the most important countries measured on this basis experienced a positive upward trend over the period 2014-16, although the UK slipped from being ranked first to second over the period 2015-16. This was due to a significant net increase in turnover in Germany throughout this three-year period of +24% (compared with +4% in the UK over the same period). The top 6 EU28 countries account for approximately 74% of turnover generated across all EU28 countries.

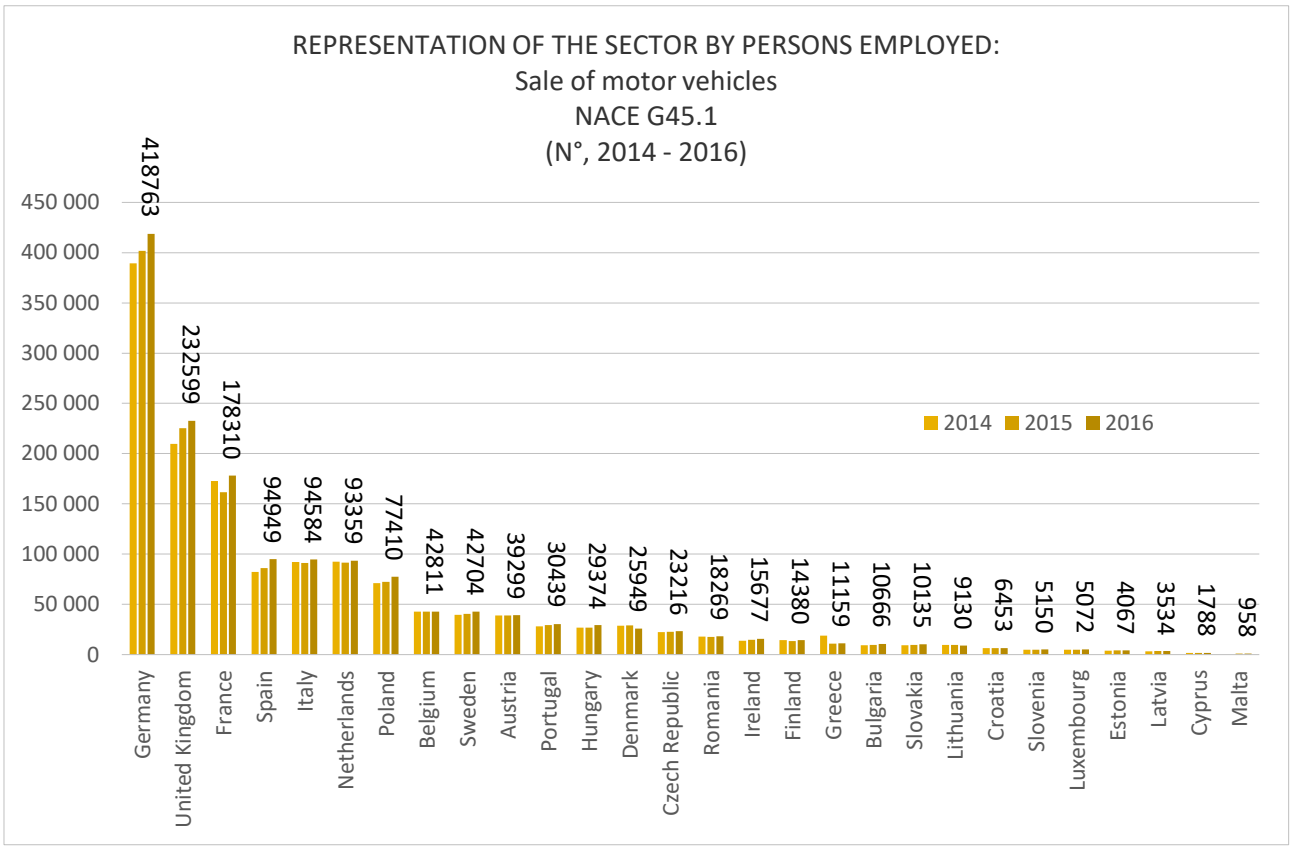

Figure 49: PERSONS EMPLOYED: SALE OF MOTOR VEHICLES (NACE G45.1)

In relation to turnover relating to NACE code G45.1, most of the most important countries measured on this basis experienced a positive upward trend over the period 2014-16, although the UK slipped from being ranked first to second over the period 2015-16. This was due to a significant net increase in turnover in Germany throughout this three-year period of +24% (compared with +4% in the UK over the same period). The top 6 EU28 countries account for approximately 74% of turnover generated across all EU28 countries.

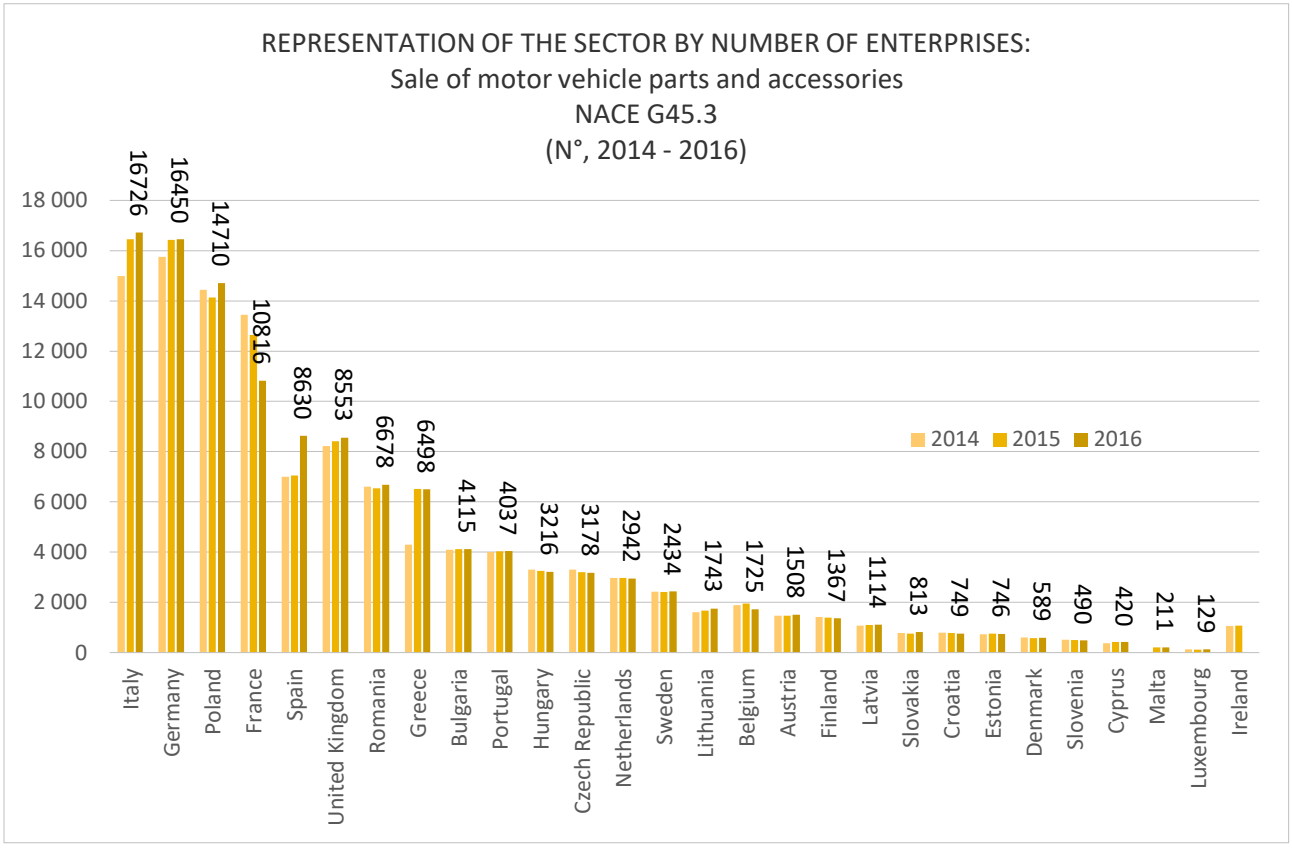

Figure 50: NUMBER OF ENTERPRISES: SALE OF MOTOR VEHICLE PARTS AND ACCESSORIES (NACE G45.3)

With respect to NACE code G45.3, in relation to the number of enterprises, Italy, Germany, Poland and France have the highest concentration of enterprises accounting for about 50% of the EU28 sub-sector total. With the exception of France, all these four countries have experienced net gains over the period 2014-16. By contrast France experienced a net decline of -20% over this period. Spain, ranked 5th on this basis experienced a net gain in relation to the number of enterprises of +23%.

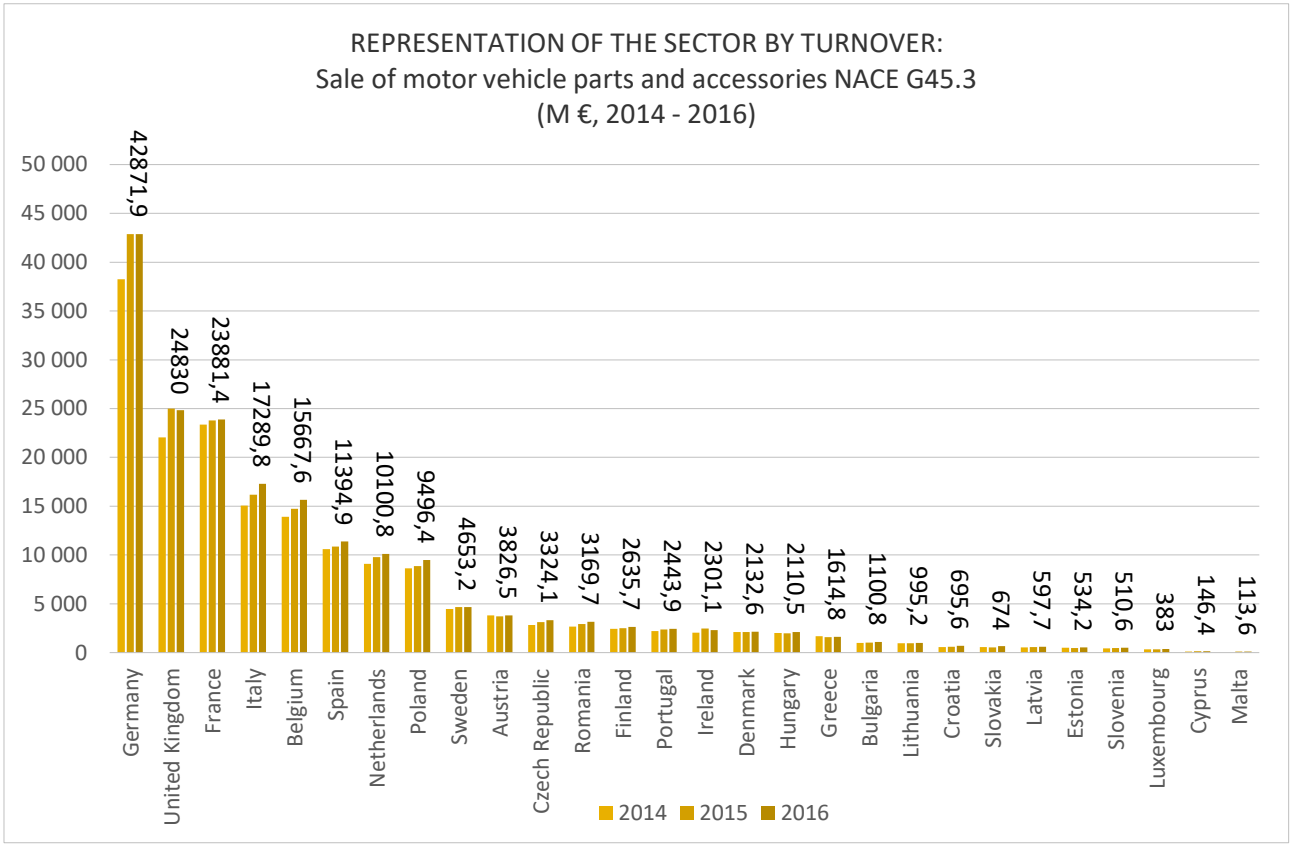

Figure 51: TURNOVER: SALE OF MOTOR VEHICLE PARTS AND ACCESSORIES (NACE G45.3)

Based on turnover in the sub-sector Germany is ranked first, with a turnover equal to sum of the second and third placed EU28 countries (UK and France). With the exception of France, the top 6 countries all experienced significant net growth of on average +12,5% over the period 2014-16. By contrast the respective figure for France was +2,2%. More than 70% of all EU 28 enterprises in the sub-sector are located within these top 6 countries.

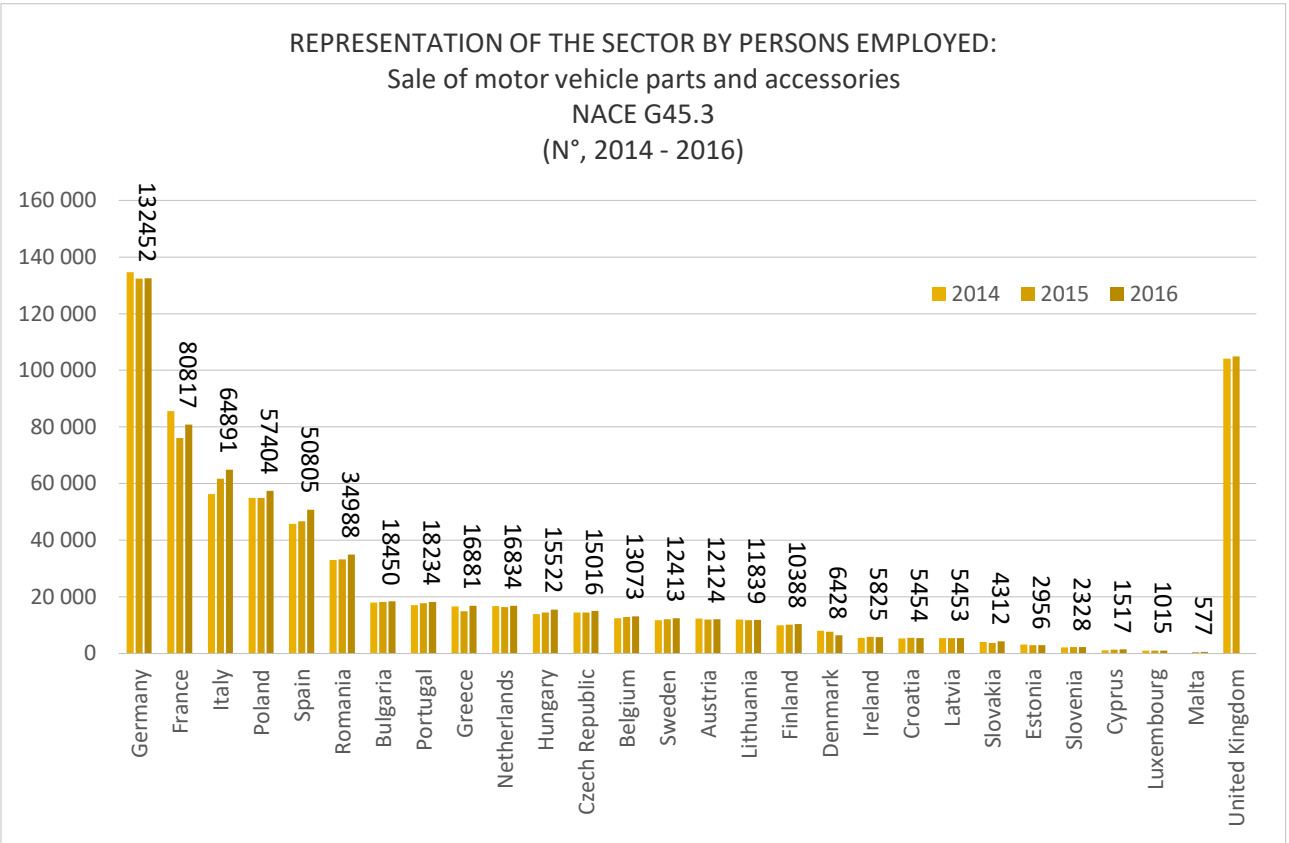

Figure 52: PERSONS EMPLOYED: SALE OF MOTOR VEHICLE PARTS AND ACCESSORIES (NACE G45.3)

It should be noted that figures relating to the UK for 2016 in relation Figure 52, are not correct. Based on 2015 data for the sub-sector, Germany is ranked first based on numbers employed, with the UK ranked second. The Top 6 EU28 countries account for more than 70% of employment in the sub-sector.

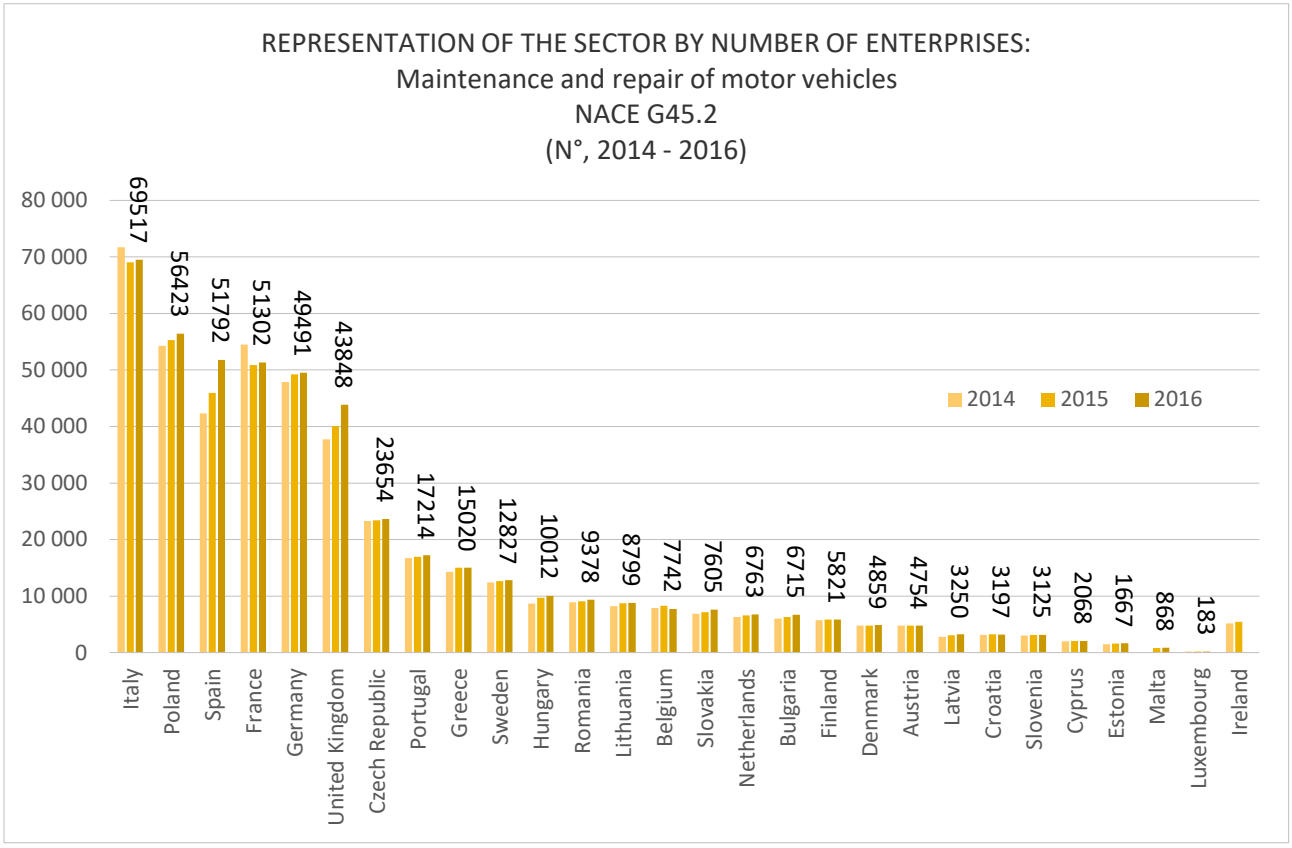

Figure 53: NUMBER OF ENTERPRISES: MAINTENANCE AND REPAIR OF MOTOR VEHICLES (NACE G45.2)

In relation to NACE code G45.2, in terms of numbers of enterprises, Italy is ranked first of the EU28 countries followed by Poland, Spain, France, Germany and UK, which collectively account for 70% of total enterprises. In terms of trends, Spain is particularly notable, experiencing a net gain of +22% over the period 2014-2016.

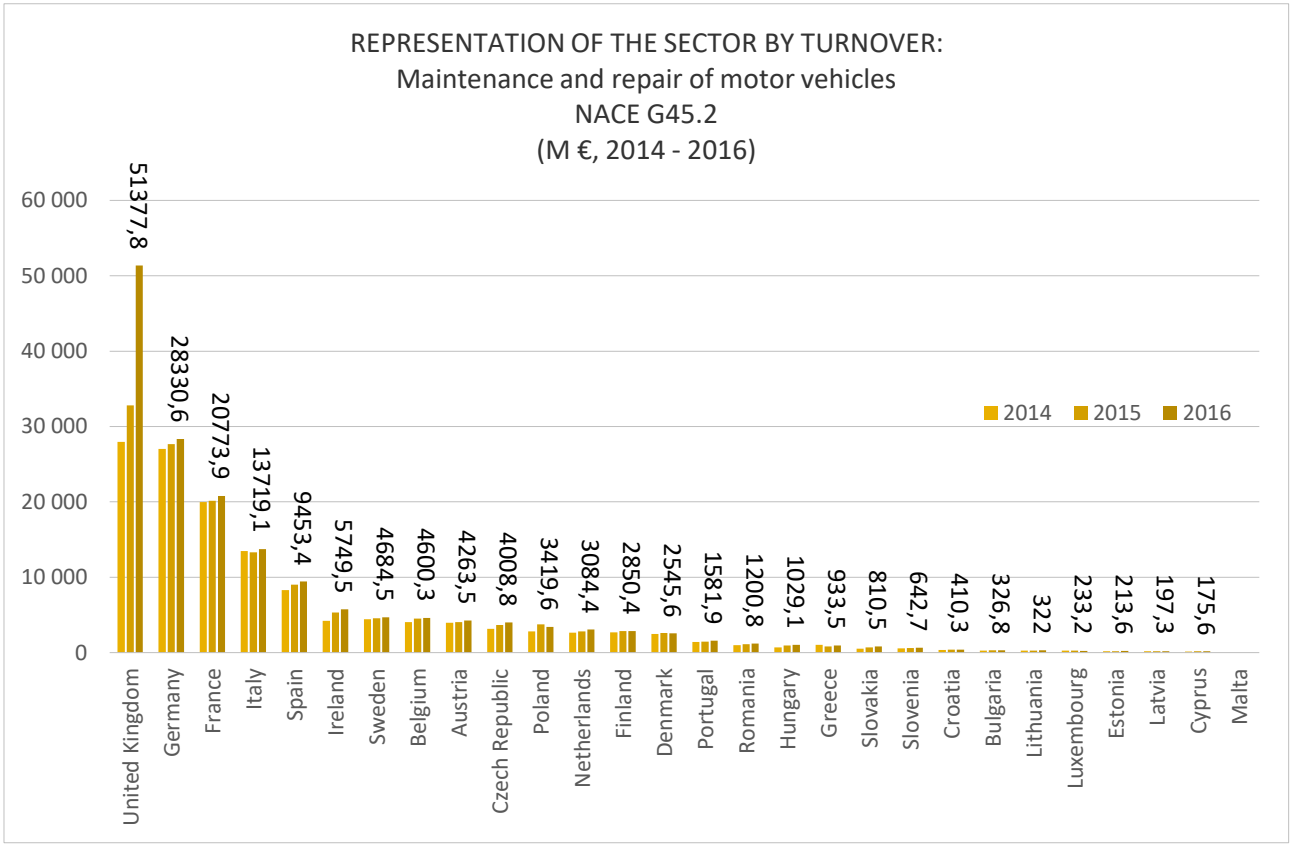

Figure 54: TURNOVER: MAINTENANCE AND REPAIR OF MOTOR VEHICLES (NACE G45.2)

In relation to turnover within the sub-sector, Eurostat data relating to the UK is unreliable. However, it should be noted that the country's aftermarket sector has proven to be an attractive marketplace for foreign direct investment and continues to see consistent increases in capital expenditure, in line with some trends relating to the increased use of electronics and software within modern vehicles[67]. The UK aftermarket is likely to grow at an annual rate of 3% per year between 2018 and 2022, with higher growth in services and repair compared to the retail of parts. This growth will be driven by a powerful combination of an increasing number of cars on the road, from more than 30 million in 2015 to 32.0 million by 2022, and the increasing age of cars in the UK from an average of 7.8 to 8.1 years over the same period.

Second ranked Germany has experienced a steady increase in turnover over the period 2014-16 based on Eurostat data

67 https://www.smmt.co.uk/wp-content/uploads/sites/2/FS_SMMT_THE-IMPORTANCE-OF-THE-UK-AFTERMARKET.pdf

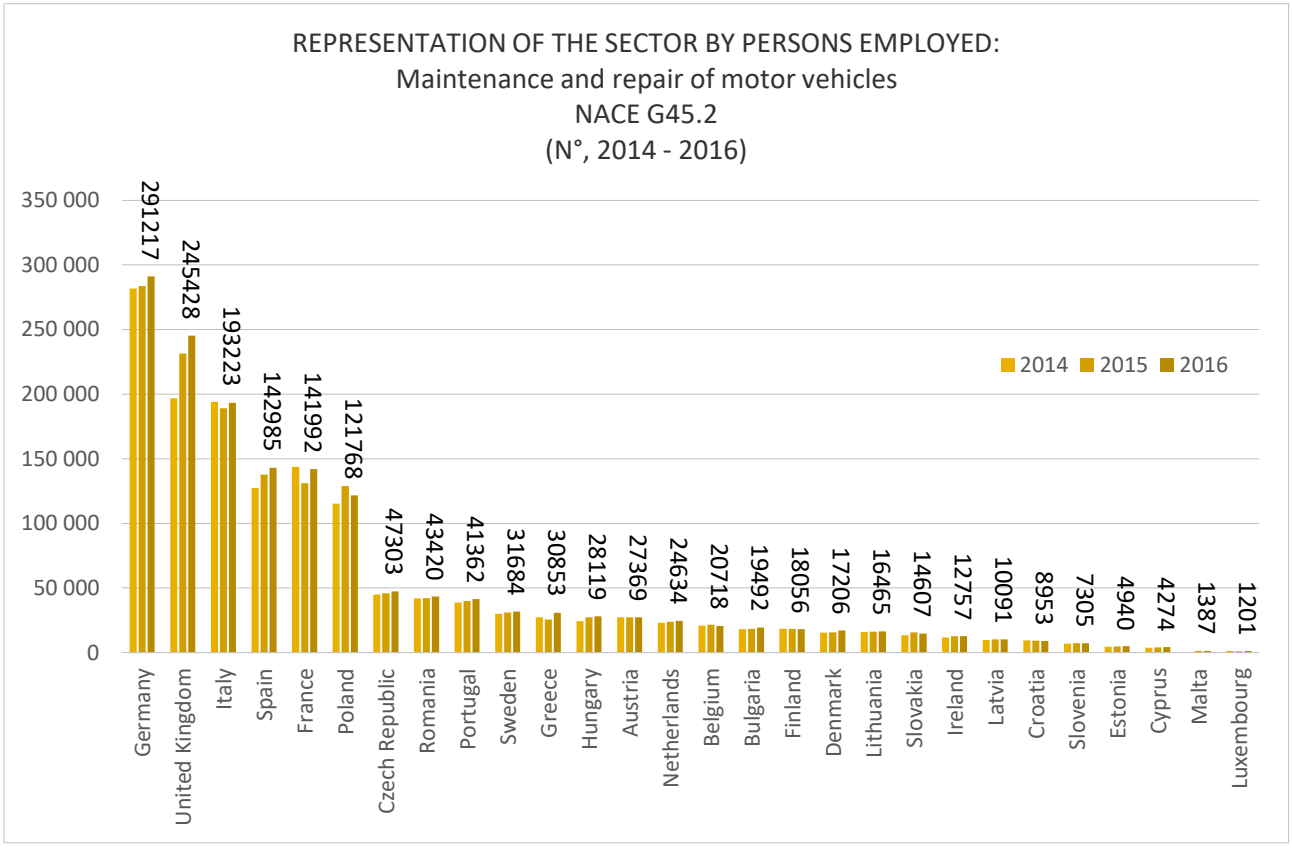

Figure 55: PERSONS EMPLOYED: MAINTENANCE AND REPAIR OF MOTOR VEHICLES (NACE G45.2)

Currently the UK aftermarket provides 345,600 jobs, 73% of which are in the independent aftermarket[68]. British aftermarket companies continue to attract interest from global competitors who see the value and growth potential of the domestic industry.

68 https://www.smmt.co.uk/wp-content/uploads/sites/2/FS_SMMT_THE-IMPORTANCE-OF-THE-UK-AFTERMARKET.pdf

7.2 REPORTS AND DOCUMENTS USED TO MAP DRIVERS OF CHANGE AND SKILLS

[a] Transforming vehicle production by 2030 – How shared mobility and automation will revolutionize the auto industry, PricewaterhouseCoopers, 2018

[b] Ready for inspection – the automotive aftermarket in 2030, McKinsey, 2018

[c] https://www.ilsole24ore.com/art/tecnologie/2018-10-15/le-competenze-futuro-ripartono-persone-e-nuovi-linguaggi-172410.shtml?uuid=AETplKLG

[d] www.automotivecouncil.co.uk

[e] Making the future of mobility work, Deloitte, 2017

[f] Automotive revolution – perspective towards 2030, McKinsey, 2016

[g] Five trends transforming the Automotive Industry, PricewaterhouseCoopers, 2017-2018

[h] Forces of change: the future of mobility, Deloitte, 2017

[i] Three surprising resource implications from the rise of electric vehicles, McKinsey, 2018

[j] A road map to the future for the auto industry, McKinsey, 2014

[k] Global Automotive Consumer Study - The changing nature of mobility, exploring consumer preferences in key markets around the world, Deloitte, 2014

[l] The future of the Automotive Value Chain – 2025 and beyond, Deloitte, 2017

[m] Accelerating toward 2020 – An automotive industry transformed, Deloitte, 2009

[n] Lithium and cobalt: A tale of two commodities, McKinsey, 2018

[o] European Sector Skill Council: Report, Eu Skill Council Automotive Industry, 2013

[p] GEAR 2030, High Level Group on the Competitiveness and Sustainable Growth of the Automotive Industry in the European Union, 2017

[q] Employers' Views of the Jobs and Skills Required for the UK Automotive Industry, Automotive Council UK, 2016

[r] Osservatorio sulla componentistica automotive italiana, Università Ca' Foscari Venezia, 2016

7.3 WP2 OCCUPATION MAPPED

CLASSIFICATION		CHARACTERISATION		
ISCO Classification level I	**ISCO** Classification level II	**OCCUPATIONS**	**DESCRIPTION OF OCCUPATION, MISSION**	**WORK CONTEXT**
Professionals	21 Science and Engineering Professionals	**Quality Engineer**	Quality engineers monitor and audit the quality of all manufactured goods in a variety of industries, including the automobile, textile, clothing, food, and electronics industries. They work to not only find defects, but also to find the cause of the defect and develop a solution	Quality engineers test products to determine how long they will last, what part may break down first and how to improve product durability. They inspect product materials, mechanics and electrical systems. Materials quality engineers verify product dimensions, color, texture and strength and locate imperfections. Mechanical quality engineers check levels of liquids and gasses, verify that parts move correctly and test the proper fit of components. Electrical quality engineers check the flow of electricity and ensure the proper operation of equipment and machinery. Quality engineers may work in laboratory settings running tests and duplicating real-world conditions. They use tools such as micrometers, calipers, gauges, volt meters, ammeters, and ohmmeters, as well as electronic inspection equipment like coordinate measuring machines (CMMs), to aid them in their work. The quality engineer also designs systems by which production quality can be checked in an ongoing process. In addition, quality engineers typically work with the production team to implement any new testing criteria or assembly methods they may have developed.
Professionals	21 Science and Engineering Professionals	**Design Engineer**	Design engineers develop new conceptual and detailed designs. They create the look for these concepts or products and the systems used to make them. Design engineers work with engineers and marketers to enhance the functioning and efficiency of existing devices.	assess financial viability define technical requirements execute analytical mathematical calculations execute feasibility study interpret technical requirements manage engineering project perform scientific research present detailed design proposals use technical drawing software
Manager	13 Production and Specialized Services Managers	**Sustainability Manager**	Sustainability managers ensure that their company upholds and works towards finding new, and innovative economically reductive ways to stay green	Implement changes and communicate them effectively Measure your company's sustainability performance Analyse and audit

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Technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Lean Six Sigma Yellow Belt**	A Yellow Belt will usually be a general member of the workforce, utilized for their skills, knowledge, or experience within the process that is being reviewed by the Six Sigma project.	The role of the Yellow Belt is likely to include assisting in the gathering of measurements and metrics during the Measure stage. They will also be acting as a subject matter expert on the process being reviewed. They will also be working with project Green Belts to create communication plans that will explain the improvements and process changes to employees and departments affected by the project.
Technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Lean Six Sigma Orange Belt**	Lean Six Sigma Orange Belts are executing Kaizen and Lean projects or less complicated Six Sigma projects in their immediate environment. Orange Belts are often team leaders or supervisors with in-depth knowledge of a process, product or equipment.	With Orange certification, you will learn the difference between Muda (waste) and Mura (unevenness). You will be introduced to numerous Six Sigma concepts, plus various Lean performance metrics, and useful tools like value stream mapping. Furthermore, Orange Belt training sets you up Green Belt study, as you strengthen your management skills and learn how to create capable processes.
Technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Lean Six Sigma Green Belt**	Green Belts are employees of an organization who have been trained on the Six Sigma improvement methodology and will lead a process improvement team as part of their full-time job. There is more time spent on the decision-making and strategy-building components of key elements in the Six Sigma project planning process. They have a deeper understanding of the overall process; they work with centralized project managers on delivering feedback and driving performance goals.	● Lead 'Six Sigma improvement' project's team. ● Operates under the supervision of a Six Sigma Black Belt. ● Analyzes and solves quality problems. ● Participated in a project, but has not led a project ● Coordinate with the data collection process team of their project and validate the measurement system ● Green Belts usually work on projects within their own functional area. ● Able to improve their team facilitation skills. ● Developing Project charter and SIPOC (Supplier, Input,Process and Output) Diagram for their project.
Technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Lean Six Sigma Black Belt**	Black Belts lead the Six Sigma improvement process. Their experience leading, motivating, and influencing project teams give them the leadership ability to implement the Six Sigma vision dictated by Master Black Belts.	Black Belts must be comfortable with managing and driving change. It requires finesse to be an enthusiastic change agent without upsetting or unsettling team members or other members of the company. Black Belts must be clear and effective communicators to succeed in their roles as Six Sigma leaders, mentors, coaches and trainers. In the course of their day, Black Belts will communicate with employees at all levels of the company. They must be able to speak the language of the C-suite and the shop floor equally well.

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Professionals	21 Science and Engineering Professionals	**Automotive Engineer (understanding mechatronics in an overview)**	Automotive engineers design and oversee the manufacturing process and operation of motor vehicles such as motorcycles, cars, trucks, buses and their respective engineering systems. They design new vehicles or mechanical parts, supervise modifications and resolve technical problems. They make sure the designs comply with cost specifications and other constraints. They also conduct research studying environmental, energy and safety aspects.	adjust engineering designs analyse production processes for improvement approve engineering design assess financial viability automotive engineering control production execute feasibility study perform scientific research use technical drawing software
Manager	13 Production and Specialized Services Managers	**Compliance Manager**	Compliance engineers strive to keep the highest compliance of systems with engineering specifications. They can exert compliance in a varied array of engineering fields including mechanical, electrical, electronical systems. They ensure the engineering complies with regulations, safety measures, and internal directives.	adjust engineering designs analyse production processes for improvement approve engineering design assess financial viability automotive engineering control production execute feasibility study perform scientific research use technical drawing software
Manager	13 Production and Specialized Services Managers	**Innovation Manager**	An innovation manager is an employee whose responsibilities focus on the development of new products, services or processes.	Innovation managers are skilled in project management, strategic thinking and leadership. They're capable of fostering individual and collective creativity, and they're also able to create processes and procedures for ideation, prototyping and production. They're also able to balance risks against the potential rewards of their teams' work, based on organizational tolerance for risk and organizational objectives, as well as other factors. Innovation managers tend to be creative and visionary, with the ability to see opportunities and the business acumen to shepherd ideas from the visionary stage through to production.

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Technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Maintenance technician**	a maintenance technician requires a basic set of core skills and competence to carry out the occupation appropriately:	using and interpreting metalworking data and documentation working effectively and efficiently in a metalworking environment carrying out fault diagnosis on mechanical equipmentmaintaining and repairing mechanical equipment carrying out preventive maintenance of mechanical equipment completing and successfully handing over maintenance activities skills to deal with mechanical and electronic equipment skills to deal with automation processes, robotics (including micro-robotics)
Plant and Machine Operators and Assemblers	81 Plant and Machine Operators and Assemblers	**CNC operator**	Computer numerical control machine operators set-up, maintain and control a computer numerical control machine in order to execute the product orders. They are responsible for programming the machines, ensuring the required parameters and measurements are met while maintaining the quality and safety standards.	consult technical resources ensure equipment availability monitor automated machines operate precision measuring equipment perform machine maintenance perform test run program a CNC controller read standard blueprints remove inadequate workpieces remove processed workpiece set up the controller of a machine supply machine supply machine with appropriate tools troubleshoot use CAM software use automatic programming

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Craft and Related Trades Workers	73 Handicraft and Printing Workers	**Automotive Paint Technician**	Automotive Paint Technician use painting machines and hand tools to coat individual parts and to paint the surface of all types of transport equipment such as cars, buses, boats, aircraft, motorcycles and railway cars. They prepare the surface of the pieces for the paint and apply the coaat. Transport equipment painters can perform industrial painting or individual customisation. They may also remove or repair painting errors such as scratches.	analyse the need for technical resources apply colour coats apply health and safety standards apply preliminary treatment to workpieces check paint consistency clean painting equipment dispose of hazardous waste ensure equipment availability fix minor vehicle scratches follow control of substances hazardous to health procedures handle chemical cleaning agents inspect paint quality keep records of work progress maintain work area cleanliness mix paints for vehicles monitor painting operations paint with a paint gun prepare vehicles for application of paint protect workpiece components from processing troubleshoot use color matching techniques use drying equipment for vehicles use paint safety equipment use painting equipment use power tools use technical documentation

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Plant and Machine Operators And Assemblers	82 Assemblers	**Assembly line operative/assembler**	Assemblers would need to have the following knowledge, skills and competence:	following the relevant instructions, assembly drawings and any other speci cations ensuring that the appropriate components are available and that they are in a usable condition using the appropriate methods and techniques to assemble the different components in their correct positions checking the completed assembly units to ensure that all operations have been completed and that the nished product meets the required speci cation working together with colleagues, both upstream and downstream dealing promptly and effectively with risks and delays in assembly line production and reporting problems that cannot be solved. working safely at all times, complying with health and safety, environmental and other relevant regulations and guidelines' identifying areas for process and quality improvement". an understanding of automatic assembly processes and the ability to reproduce process manually when working with tyre assembly machines, a basic knowledge of electronics 5S skills – sort, straighten, shine, standardise, sustain team working skills an understanding of just-in-time production demands an ability to communicate effectively
Clerical Support Workers	43 Numerical and Material Recording Clerks	**Materials planning analysis**	Materials planning analysis would need to have the following knowledge, skills and competence:	- establishing and coordinating plans for managing and forecasting material needs for production purposes - using supply chain management concepts to minimise inventory, handling and logistics costs understanding and implementing sound nancial accountin
professionals	21 Science and Engineering Professionals	**Product engineer**	Product Engineer would need to have the following knowledge, skills and competence:	knowledge of materials and multi-material design knowledge on new design and simulation tools „ knowledge of regulatory aspects ability to work in multidisciplinary and international teams ability to communicate effectively problem solving and project management skills
professionals	21 Science and Engineering Professionals	**Process engineer**	Process engineer would need to have the following knowledge, skills and competence:	knowledge of new materials and related processes knowledge and experience in mechatronics „ ICT skills for use in production systems ability to work in multidisciplinary and international teams ability to communicate effectively problem solving and project management skills

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professionals	25 Information and Communications Technology Professionals	**R&D engineer/technician**	R&D engineer would need to have the following knowledge, skills and competence:	knowledge of materials and multi-material design knowledge on new design and simulation tools „ knowledge of regulatory aspects ability to work in multidisciplinary and international teams ability to communicate effectively problem solving and project management skills basic understanding of the manufacturing process competence in terms of entrepreneurship basic knowledge of the ways in which supply chains function understanding of technological applications for advanced material and in advanced manufacturing understanding of market trends so as to respond to consumer requirements ability to work in teams ability to communicate effectively
technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**3D printing technician**	3D printing technician would need to have the following knowledge, skills and competence:	- knowledge of software applications and hardware knowledge of new materials ability to follow relevant instructions, assembly drawings and any other speci cations ability to use the appropriate methods and techniques to print the different components ability to check the completed components so as to ensure that the nished product meets the required speci cation ability to work together with colleagues, both upstream and downstream ability to deal promptly and effectively with risks and delays in assembly line production and reporting any problems that occur.

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technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Product design and development technician**	A product design and development technician would primarily work on all stages of product creation and modi cation and need to have the following knowledge, skills and competence:	working safely at all times, complying with health and safety legislation, regulations, directives and other relevant guidelines effectively using and interpreting a range of engineering data sources and documentation organising work ef ciently and effectively in engineering resources when completing tasks producing components and prototypes using a wide range of hand tting and joining techniques preparing and using machining, electrical or electronics equipment, as well as other general or specialist high-tech equipment producing assemblies and rigs using a range of materials and techniques applying and testing mechanical, electrical and electronic devices and equipment maintaining and testing instrumentation within product devices using engineering project planning methods within the prototyping context using business improvement planning techniques
professionals	21 Science and Engineering Professionals	**Product developer**	Product development engineering technicians improve efficiency of product development, set up equipment and develop and test solutions to solve technical problems. They work closely with engineers and technologists, inspect products, conduct tests and collect data.	adjust engineering designs analyse test data collaborate with engineers create solutions to problems develop product design inspect quality of products provide advice to technicians troubleshoot use CAD software
technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Mechatronic technician**	Mechatronics engineering technicians collaborate with engineers in the development of mechatronic devices and applications through a combination of mechanical engineering, electronic engineering, and computer engineering. They build, test, install, and calibrate mechatronics and solve technical problems.	Adjust engineering designs Align components Assemble mechatronic units Assist scientific research Fasten components Follow safety standards in industrial contexts Inspect quality of products Install mechatronic equipment Liaise with engineers Perform test run Prepare production prototypes Read assembly drawings Read engineering drawings Record test data Simulate mechatronic design concepts Test mechatronic units

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professionals	21 Science and Engineering Professionals	**Renewable energy specialist**	Renewable engergy specialists would need to have the following knowledge, skills and competence:	Renewable energy engineers research alternative sources of energy in order to design systems for renewable energy production. They strive to optimise energy production from renewable sources, and reduce production expenses and environmental strain. They design systems which focus on energy sustainability and efficiency OR Renewable energy consultants advise clients on the advantages and disadvantages of different renewable energy sources. They conduct surveys and interviews to research demand of and opinions on renewable energy, and strive to advise clients on the most advantageous source of renewable energy for their purpose.
professionals	21 Science and Engineering Professionals	**Manufacturing systems engineer**	The aim of a manufacturing systems engineer is to make a production process as efficient as possible, so factories can make goods and products on time and on budget	•designing the layout of the plant using computer-aided design/manufacturing (CAD/CAM) software to build 3D models •designing, developing and installing plant control systems •liaising with designers, researchers and engineering consultants •attending production meetings and forecasting production requirements •calculating production costs that include equipment, time and labour •deciding on the effective use of resources, e.g. raw materials, equipment and staff •producing maintenance schedules •testing systems are working correctly and identifying, investigating and repairing any system faults •discussing and evaluating systems failures with plant managers and non-technical personnel •supervising the work of manufacturing engineers, trainee engineers and support staff •overseeing the installation, repair and re-assembly of equipment •demonstrating new and existing equipment to systems engineers, support staff and production managers •investigating environmental hazards as well as conducting safety tests and removing potential hazards •meeting with managers to discuss methods of improving the productivity of existing systems, taking into consideration the use of the latest technology •sourcing new suppliers of industrial equipment •testing, monitoring and evaluating new mechanical equipment •establishing and implementing a quality culture within the manufacturing environment •visiting other production sites.

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professionals	21 Science and Engineering Professionals	**Research Engineer**	Research engineers combine research skills and knowledge of engineering principles aiming to improve through research, processes, techniques, products, and systems at large. They perform experiments, for instance of natural structures such as honeycombs or tear-resistant spiderwebs, before determining the viability of alternative methods on a larger scale.	collect samples for analysis define technical requirements execute feasibility study gather experimental data interpret technical requirements manage engineering project perform scientific research use technical drawing software
professionals	24 Business and Administration Professionals	**Cost Estimator**	Manufacturing cost estimators collect and analyse data to evaluate the money, materials, labour and time required for manufacturing processes. They conduct analyses to identify (alternative) cost effective technical designs and production processes. They develop and use methods and tools for cost planning, controlling and analysis. They also perform quantitative and qualitative risk analyses and report on the development of costs.	assess financial viability execute analytical mathematical calculations provide cost benefit analysis reports

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manager	13 Production and Specialized Services Managers	**Warehouse Manager**	Warehouse managers assume the responsibility for storage facilities. They manage the operations and the staff within.	apply safety management build business relationships coach employees comprehend financial business terminology create a work atmosphere of continuous improvement create solutions to problems ensure efficient utilisation of warehouse space ensure stock storage safety exert a goal-oriented leadership role towards colleagues give instructions to staff improve business processes maintain financial records maintain physical condition of warehouse maintain stock control systems maintain warehouse database manage a warehouse management system manage dispatch software systems; manage inventory manage staff manage third-party logistics providers manage warehouse operations manage warehouse organisation meet productivity targets monitor security procedures in warehouse operations monitor storage space oversee freight-related financial documentation oversee warehouse value-added activities perform cost accounting activities plan future capacity requirements plan the dispatching of products plan the stocking of products provide staff training in warehouse management schedule shifts t- rain employees - use different communication channels - work in a logistics team
professionals	21 Science and Engineering Professionals	**Automotive Designer**	Automotive designers create model designs in 2D or 3D and prepare isometric drawings and graphics. They also conduct research collecting data about (new) materials, market trends and production processes.	draw design sketches execute analytical mathematical calculations liaise with engineers read engineering drawings use a computer

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manager	13 Production and Specialized Services Managers	**Logistics Manager**	Logistics and distribution managers take decisions on logistic services, operations and provisions. They take internal and external variables into consideration for effective and successful organisational logistic services. They give appropriate support to all the activities of the supply chain from the beginning to the end. These professionals organise the storage and distribution of goods and ensure that the right products are delivered to the right location on time and at a good cost.	analyse supply chain strategies analyse supply chain trends anticipate the overhaul of the fleet communicate with shipment forwarders comply with checklists conduct full-scale emergency plan exercises consider economic criteria in decision making control reorder points coordinate dock operations develop efficiency plans for logistics operations encourage teams for continuous improvement ensure continuous preparedness for audits give instructions to staff handle stressful situations liaise with colleagues liaise with transportation companies manage dispatch software systems; manage staff manage the fleet according to planned operations perform cost accounting activities provide operational efficiency training to employees solve operational transport problems understand supply chain improvements in relation to profit gains - work in a logistics team
manager	13 Production and Specialized Services Managers	**Lean Manufacturing Manager**	Responsible and accountable for continuous improvement and efficiencies across the Company's products, systems, operations and processes. Likely to lead a team of people and have budgetary/cost reporting responsibility. Likely to be an expert in lean methodologies with a Master Black Belt or equivalent qualification. Coaches, trains and assesses others.	Working with the Senior Management Team, develop, set the pace and implement business transformational and continuous improvement strategy with sensitivity towards the organisational structure, commercial approach, culture, people and processes. Outline direction and deployment of the Lean framework to ensure consistent and rigorous application across the business in line with best practice. Responsible for the successful management and implementation of business improvement projects/initiatives across the business by developing an enthusiastic, motivated and flexible team and building working relationships ensuring that Health, Safety and Environmental requirements are adhered to.
professionals	24 Business and Administration Professionals	**Lean Master Practitioner**	Leads continuous improvement and efficiency projects across the Company focussing on products, systems, operations and processes. Likely to be highly knowledgeable in six sigma methodology with a Black Belt or equivalent qualification. Coaches, trains and assesses others.	Identify opportunities and develop business cases for Lean process improvement projects within the business, including other stakeholders where necessary. Facilitate and deliver significant sized complex business improvement projects using Lean and Six Sigma techniques to achieve long-term business strategies and develop a Lean culture across the business.

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technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Lean Practitioner**	Participates in a continuous improvement and/or efficiency project within a Company focusing on products, systems, operations and processes. Likely to have a yellow belt six sigma qualification. Will carry out these duties as part of their overall function within the organisation.	Participate in and contribute to lean improvements activities, looking at safety, quality, delivery, productivity, cost and efficiency, delivering benefits to support customer satisfaction. Bring knowledge of their area of work to the lean process.
professionals	21 Science and Engineering Professionals	**Quality Engineer**	Quality engineers define quality standards for the creation of products or services. They check to make sure the products and services are in compliance with the quality standards and they coordinate quality improvements.	analyse test data define quality standards identify improvement actions identify process improvements inspect quality of products perform risk analysis recommend product improvements record test data report test findings set quality assurance objectives support implementation of quality management systems undertake inspections write inspection reports
technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Light weight material specialist**	A light weight specialist has a fundamental material knowledge how to replace existing materials by lighter ones.	
professionals	21 Science and Engineering Professionals	**Rubber technologist**	A rubber technologist knows how to create a rubber compound, how the different materials in a rubber compound behave and how to process a rubber compound. He is able to adjust existing rubber compounds due to the new upcoming requirements of the automotive sector.	
technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Compounde**	A compounder knows which materials have to be combined to create a suitable compound. He deals with composites, thermoplasts and rubber for the use in the automotive industry and has a deep material knowledge.	
professionals	21 Science and Engineering Professionals	**Process engineer * duplicated title with Skills Council**	A process engineer knows how materials behave during processing. He is able to set-up, control and adjust processing steps in the automotive industry	

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technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Recycle**	A recycler knows which renewable materials are on the market and can be re-used in the automotive sector. Furthermore, he knows which materials can be recycled and are able to select "green" materials according to this knowledge	
Clerical Support Workers	43 Numerical and Material Recording Clerks	**Capacity Planner**	Capacity planners ensure that the capacity of services and infrastructure is able to deliver agreed service level targets in a cost effective and timely manner. They also consider all resources required to deliver the appropriate service, and plan for short, medium, and long term business requirements.	analyse business requirements apply company policies carry out statistical forecasts develop financial statistics reports ensure adherence to organisational standards forecast workload improve business processes perform business analysis perform resource planning plan capacity provide cost benefit analysis reports
professionals	21 Science and Engineering Professionals	**Chief Engineer**	Chief engineers are responsible for the entire technical operations including engineering, electrical, and mechanical divisions. They are the head of the entire engineering department. They have overall responsibility for all technical operations and equipment. Chief engineers observe the national and international standards of application.	analyse work-related written reports carry out calculations communicate verbal instructions conduct financial audits maintain equipment maintain documentation manage staff operate mechanical equipment perform quality audits repair electrical systems repair mechanical systems
professionals	21 Science and Engineering Professionals	**Robotics Engineer**	Robotics engineers design and develop robotic devices and applications in combination with mechanical engineering principles. They use pre-established designs and current developments for improving or inventing systems, machinery and equipment. They combine several knowledge fields such as computing, engineering, and electronics in the development of new engineering applications.	adjust engineering designs approve engineering design assess financial viability design automation components execute feasibility study perform scientific research use technical drawing software

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technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Electronic Engineering Technician**	Electronics engineering technicians perform technical tasks to aid in electronic research and in the design, manufacture, assembly, construction, operation, maintenance and repair of electronic equipment.	providing technical assistance in research and development of electronic equipment, or testing prototypes; designing and preparing blueprints of electronic circuitry according to the specifications given; preparing detailed estimates of quantities and costs of materials and labour required for the manufacture and installation of electronic equipment, according to the specifications given; monitoring technical aspects of the manufacture, utilization, maintenance and repair of electronic equipment to ensure satisfactory performance and ensure compliance with specifications and regulations; assisting in the design, development, installation, operation and maintenance of electronic systems; planning installation methods, checking completed installations for safety and controls or undertaking the initial running of the new electronic equipment or system; conducting tests of electronic systems, collecting and analysing data, and assembling circuitry in support of electronics engineers.
technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Electrical Engineering Technician**	Electrical engineering technicians perform technical tasks to aid in electrical engineering research and in the design, manufacture, assembly, construction, operation, maintenance and repair of electrical equipment, facilities and distribution systems.	providing technical assistance in research on and development of electrical equipment and facilities, or testing prototypes; designing and preparing blueprints of electrical installations and circuitry according to the specifications given; preparing detailed estimates of quantities and costs of materials and labour required for manufacture and installation, according to the specifications given; monitoring technical aspects of the manufacture, installation, utilization, maintenance and repair of electrical systems and equipment to ensure satisfactory performance and compliance with specifications and regulations; planning installation methods, checking completed installations for safety and controls or undertaking the initial running of the new electrical equipment or systems; assembling, installing, testing, calibrating, modifying and repairing electrical equipment and installations to conform with regulations and safety requirements.

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manager	13 Production and Specialized Services Managers	**Manufacturing Manager**	Manufacturing managers plan, oversee and direct the manufacturing process in an organisation. They ensure products and services are efficiently produced within the timeframe and budget given.	adhere to organisational guidelines create manufacturing guidelines define manufacturing quality criteria develop manufacturing policies follow company standards manage budgets manage staff manage supplies meet deadlines plan health and safety procedures strive for company growth
manager	12 Administrative and Commercial Managers	**Programme Manager**	Programme managers coordinate and oversee several projects working simultaneously. They ensure workability and compatibility among projects ensuring that overall, each one of the projects under the management of project managers, turn out profitable and leveraging one to the other.	assess financial viability ensure equipment availability ensure equipment maintenance establish daily priorities evaluate project plans follow company standards identify legal requirements liaise with managers manage budgets manage logistics manage project information manage project metrics manage several projects manage staff manage supplies perform resource planning perform risk analysis plan health and safety procedures provide cost benefit analysis reports supervise daily information operations utilise economies of scale in projects

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professionals	21 Science and Engineering Professionals	**Materials Engineer**	Materials engineers research and design new or improved materials for a diverse number of applications. They analyse the composition of materials, conduct experiments, and develop new materials for industry-specific use that can range from rubber, to textiles, glass, metals, and chemicals. They advise companies in damage assessments, quality assurance of materials, and recycling of materials.	adjust engineering designs analyse production processes for improvement apply health and safety standards approve engineering design assess environmental impact create solutions to problems develop material testing procedures forecast organisational risks integrate new products in manufacturing perform chemical experiments perform scientific research test chemical samples test materials work with chemicals
professionals	21 Science and Engineering Professionals	**Manufacturing Engineer**	Manufacturing engineers design manufacturing processes for different kinds of production processes. They integrate those specificities and constraints posed by the industry or the product being produced with general and wide-spread manufacturing engineering principles into the design and planification of manufacturing processes.	adjust engineering designs advise on manufacturing problems approve engineering design assess financial viability ensure health and safety in manufacturing ensure material compliance perform scientific research use technical drawing software
professionals	21 Science and Engineering Professionals	**Production Engineer**	Production engineers review and evaluate production performance, perform data analysis and identify under-performing production systems. They search for long or short term solutions, plan production enhancements and process optimizations.	adjust engineering designs approve engineering design assess financial viability control production lead process optimisation optimise production perform scientific research use technical drawing software

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technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Quality Engineering technician**	Quality engineering technicians work with quality engineers or managers to analyse and solve quality problems and improve productivity. They examine machines for imperfections and inspect products to make sure they meet the standards. They also provide personnel with training in inspection techniques and prepare inspection plans.	conduct performance tests ensure compliance with company regulations ensure compliance with legal requirements execute software tests inspect material inspect quality of products oversee quality control perform test run record test data report test findings set quality assurance objectives undertake inspections write inspection reports
Craft and Related Trades Workers	72 Metal, Machinery and Related Trades Workers	**Tool and Die Maker**	Tool and die makers operate a variety of equipment and machinery designed to create metal tools and dies, which are both needed in several areas of manufacturing, and produce these tools in all steps of the production process. They design the tools and dies, then cut and shape them to size and finish them by manually operated machine tools, power tools, hand tools, or programming and tending CNC tool and die making machines.	adjust properties of cut apply precision metalworking techniques consult technical resources cut metal products ensure equipment availability join metals maintain edged hand tools operate file for deburring operate grinding hand tools operate metal polishing equipment perform product testing perform test run prepare pieces for joining read standard blueprints smooth burred surfaces troubleshoot wear appropriate protective gear

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professionals	21 Science and Engineering Professionals	**Automation Engineer**	Automation engineers research, design, and develop applications and systems for the automation of the production process. They implement technology and reduce, whenever applicable, human input to reach the full potential of industrial robotics. Automation engineers oversee the process and ensure all systems run safely and smoothly.	adjust engineering designs analyse test data approve engineering design conduct literature research conduct quality control analysis define technical requirements design automation components design prototypes develop electronic test procedures develop mechatronic test procedures gather technical information monitor manufacturing quality standards perform scientific research prepare production prototypes record test data report analysis results use technical drawing software
manager	13 Production and Specialized Services Managers	**Product Development Manager**	Product development managers coordinate the development of new products from beginning to end. They receive briefings and start envisioning the new product considering design, technical and cost criteria. They conduct research on market needs and create prototypes of new products for untapped market opportunities. Product development managers also improve and boost technological quality.	analyse consumer buying trends analyse data about clients calculate design costs calculate production costs combine business technology with user experience define technical requirements design customer experiences design prototypes develop new products develop product design draw conclusions from market research results follow company standards manage budgets perform market research plan product management
Plant and Machine Operators and Assemblers	81 Stationary Plant and Machine Operators	**Industrial Robot Controller**	Industrial robot controllers operate and monitor industrial robots used in automation processes to perform various manufacturing activities such as lifting, welding and assembling. They ensure that the machines are working correctly and in sync with other industrial robots, maintain and repair defective parts, assess risks and perform tests.	adjust manufacturing equipment maintain control systems for automated equipment maintain robotic equipment monitor automated machines perform machine maintenance perform risk analysis set up machine controls set up the controller of a machine wear appropriate protective gear

CLASSIFICATION		CHARACTERISATION		
ISCO Classification level I	**ISCO** Classification level II	**OCCUPATIONS**	**DESCRIPTION OF OCCUPATION, MISSION**	**WORK CONTEXT**
technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Robotics Engineering Technician**	Robotics engineering technicians collaborate with engineers in the development of robotic devices and applications through a combination of mechanical engineering, electronic engineering, and computer engineering. Robotics engineering technicians build, test, install and calibrate robotic equipment.	adjust engineering designs align components assemble robots assist scientific research fasten components follow safety standards in industrial contexts inspect quality of products liaise with engineers monitor machine operations perform test run prepare production prototypes read assembly drawings read engineering drawings record test data set up automotive robot set up machine controls test mechatronic units
technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Automotive Engineering Technician**	Automotive engineering technicians work with automotive engineers to operate, repair, maintain and test equipment used in motor vehicles. In some environments, such as an airport they are responsible for keeping equipment and vehicles serviceable. They review blueprints and designs to determine test specifications and procedures. Automotive engineering technicians use software to make sure that parts of a motor vehicle are functioning properly. They record test procedures and results, and make recommendations for changes.	adjust engineering designs execute analytical mathematical calculations liaise with engineers read engineering drawings read standard blueprints recommend product improvements troubleshoot use a computer

CLASSIFICATION		CHARACTERISATION		
ISCO Classification level I	**ISCO** Classification level II	**OCCUPATIONS**	**DESCRIPTION OF OCCUPATION, MISSION**	**WORK CONTEXT**
Plant and Machine Operators and Assemblers	81 Stationary Plant and Machine Operators/ 82 Assemblers	**Motor vehicle assembler**	Motor vehicle assemblers install and put prefabricated motor vehicle parts and components together. They inspect the motor vehicles for defects, and test the assembled equipment for proper performance and conformity to quality standards.	align components assemble electrical components assemble electronic units assemble metal parts bolt engine parts clean components during assembly drive motor vehicle prototypes ensure equipment availability fasten components keep records of work progress monitor manufacturing quality standards read engineering drawings read standard blueprints supervise motor vehicles manufacture troubleshoot use power tools use technical documentation work in assembly line teams
technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Motor vehicle assembly supervisor**	Motor vehicle assembly supervisors coordinate the employees involved in motor vehicle manufacturing and schedule their activities. They prepare production reports and recommend measures to reduce the cost and improve productivity such as hiring, ordering new equipment and implementing new production methods. They train employees in company policies, job duties and safety measures. They oversee the supplies and communicate with other departments to avoid unnecessary interruptions of the production process.	analyse the need for technical resources coordinate communication within a team create solutions to problems evaluate employees work keep records of work progress liaise with managers manage health and safety standards oversee production requirements provide department schedule for staff read standard blueprints report on production results supervise staff supervise work train employees wear appropriate protective gear

CLASSIFICATION		CHARACTERISATION		
ISCO Classification level I	**ISCO** Classification level II	**OCCUPATIONS**	**DESCRIPTION OF OCCUPATION, MISSION**	**WORK CONTEXT**
technicians and Associate Professionals	31 Science and Engineering Associate Professionals	**Motor vehicle assembly inspector**	Motor vehicle assembly inspectors use measuring and testing equipment to inspect and monitor motor vehicle assemblies to ensure conformity to engineering and manufacturing specifications, quality, and safety standards and regulations. They detect malfunction and damage and inspect repair work. They also provide detailed inspection documentation and recommend action where problems are discovered.	conduct performance tests create solutions to problems inspect quality of products manage health and safety standards monitor manufacturing quality standards notify supervisor read engineering drawings read standard blueprints supervise motor vehicles manufacture use technical documentation write inspection reports

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