DRIVES

Development and Research on Innovative Vocational Education Skills

AUTOMOTIVE SKILLS AGENDA

STRATEGY & ROADMAP

Deliverable 2.11

Automotive Skills Strategic Roadmap – Third release

December 2021

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	Pilar Pérez, Katarzyna Doraczynska CLEPA		Review date:	17/12/2021
	Fazilet Cinaralp, Marta Conti, ETRMA		Review date:	20/12/2021
	Utimia Madaleno, Eupportunity		Review date:	27/12/2021
Approved by:	Jakub Stolfa, VSB-TUO		Approval date:	30/12/2021

More information about DRIVES project and contact:

www.project-drives.eu

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LIST OF ABBREVIATIONS

ABBREVIATION	MEANING
ACEA	European Automobile Manufacturers' Association
ADAS	Advanced Driver-Assistance Systems
AI	Artificial Intelligence
ALBATTS	(the) Alliance for Batteries Technology, Training and Skills
ASA	Automotive Skills Alliance
B2B	Business to business
BI	Business Intelligence
BREXIT	British exit
CAR2X	Car to Everything
CEDEFOP	European Centre for the Development of Vocational Training
CLEPA	European Association of Automotive Suppliers
CO_2	Carbon Dioxide
COSME	Competitiveness of Enterprises and SMEs (EU programme)
COVID-19	Coronavirus Disease 19
CVET	Continuing Vocational Education and Training
D x.y	Deliverable x.y
DoC	Driver of Change
DRIVES	Development and Research on Innovative Vocational Educational Skills
EASCY	Electrified, Autonomous, Shared, Connected and Yearly updated
EASME	Executive Agency for Small and Medium-sized Enterprises
ESCO	European Skills/Competences, qualifications and Occupations
ETRMA	European Tyre & Rubber Manufacturers' Association
EVs	Electric Vehicle
EQF	European Qualifications Framework
EU	European Union
ECU	Electronic Control Unit
GPS	Global Positioning System
ICE	Internal Combustion Engine
IT	Information Technology
IoT	Internet of Things
IVET	Initial Vocational Education and Training
KA	Key Action
OEM	Original Equipment Manufacturer
OTA	Over The Air
P2P	Peer to peer
SA	Specific Activity
SAE	Society of Automotive Engineers
SFC	Sistemi Formativi Confindustria
SME	Small Medium Enterprise

UNECE	United Nations Economic Commission for Europe
UK	United Kingdom
USA	United States of America
V2X	Vehicle to Everything
VET	Vocational Education and Training
WG x	Working Group x
WP x	Work Package x

EXECUTIVE SUMMARY

The ongoing changes in the Automotive Sector require a high level of upskilling and reskilling of the current and future workforce. DRIVES project, as the Blueprint for Sectoral Cooperation on Skills in the Automotive sector, proposes the **Automotive Skills Strategy and Roadmap.** Published in early 2020 (1st release), the Roadmap was then updated and a 2nd release was published in December 2020. The present document is part of its final update and 3rd release.

The methodology applied for the 1st release has defined 8 **Key Actions** (KA) and 56 **Specific Activities** to be implemented by the wider automotive community as a strategic starting point to tackle the current and ongoing changes in the sector.

For the purpose of the 2nd release, each Key Action was presented and discussed with several stakeholders of the sector to investigate their relevance and consistency and if any revisions of their strategic approach were necessary. During the update, stakeholders reported that the Key Actions are valid and their implementation is crucial, with no key modifications to be done. In particular, it was possible to rank the most urgent actions as perceived by stakeholders:

- Build a common dialogue platform to inform companies and VET providers about the different needs and create a common vision for the future;
- Establish the Automotive Skills Alliance;
- Define and assure financial sustainability of the alliance;
- Support the implementation of the Key Actions;
- Ensure overall sustainable support from key stakeholders;
- Create links between automotive businesses and VET providers for widespread sharing of the results of intelligence update outcomes;
- Act as a platform for the Automotive Skills Agenda and stimulate its continuous development;
- Harmonise a set of areas and base and specific objectives that will reflect all elements of the skills agenda.

Following this methodology, the objective of this 3rd and final release was to enrich the roadmap with **information and best practices that can help the wider automotive community translate the strategy outlined in the roadmap** (1st and 2nd release) **into a set of practical and operational actions for implementation**. To do this, DRIVES Partnership engaged and involved stakeholders from regional automotive clusters, presenting four main topics during dedicated workshops. These covered:

- STANDARD DEFINITION
- FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS
- INTELLIGENCE
- TRAINING PROGRAMMES

Such topics emerged from:

- Analysis and research of best practices across the EU and a matching exercise between them and the 56 Specific Actions previously identified in the 1st release. The best practices were collected thanks to the support of WP5 – which has identified best practices already in place across the EU through the *Good Practice Resource Tool*[1].
- Analysis and research conducted within the work of the Automotive Skills Alliance (ASA)[2]. In particular, ASA partnerships within Working Group 4 (WG4) helped to better frame the 4 topics

The four main topics were presented during workshops in Germany, Italy, Poland, Portugal, Romania and Spain. These allowed a further practical deep-dive into the search and validation of successful practices that could serve as the translation of the Key Actions on a more practical level.

The first main outcomes of such activities were related to **the extreme importance of the regional aspect of the education and training**. The link between regional education and the regional labour market is critical. Moreover, the need to strengthen links with those regions with the most significant clusters of automotive activity is essential in order to support:

- Mapping of existing provision
- Identification of gaps/weaknesses in provision
- Identify changing skill needs and implications for learning support
- Mapping the available financial resources

Generally speaking, **a strong collaboration towards new common standards of production of semi-finished products, components and finished products** at every level of the automotive supply chain is mandatory to remain competitive; investing in intelligent and flexible solutions for the benefit of all the involved stakeholders by exploiting the so-called "industry 4.0" is a solution, and "**facilitating encounters between different stakeholders**" is the starting point for this solution.

[1] https://drives-compass.eu/en/home, *November 2021*
[2] https://automotive-skills-alliance.eu/, *2021*

The backbone for success is driven by Big Data information and the use of Business Intelligence tools as underlined by regional workshops outcomes within the "**intelligence**" topic. Offering stakeholders' a set of common data, forecast and sector insights allows stakeholders to concentrate themselves into "next steps" instead of "what happens" and moreover, supports a common understanding of the automotive sector direction.

The **introduction of modular and/or unitised training structures**[3] allows for easier updating of qualifications to incorporate new technologies or ways of working, and this is a priority for stakeholders involved in regionals workshops as per the "**training programmes**".

Finally, there is a clear need to **harmonise information ("standard definition")** because many training and education providers exist at a regional/national and EU level. Although various associations focus on different levels of training and education, it is challenging to have an overall view of the offer and this was also clearly visible thanks to the "offer" survey run by DRIVES project, where it was very difficult to map the existing courses and education providers that are related to automotive sector. It is also hard to compare the specific training offer by skill area and between nations, as well as define training courses and how they relate to each job role and skill.

[3] *The role of modularisation and unitisation in vocational education and training, CEDEFOP, 2015*

1 INTRODUCTION

This document represents the third release of AUTOMOTIVE SKILLS AGENDA STRATEGY & ROADMAP, which is built on and follows the first release published in May 2020 and the second published in December 2020. The three are part of the main outputs of the **D**evelopment and **R**esearch on **I**nnovative **V**ocational **E**ducational **S**kills project (**DRIVES**), the Blueprint for Sectoral Cooperation on Skills in the Automotive sector. The **DRIVES** project "drives" the Automotive Skills Agenda and ensures its development and adoption by key stakeholders. It covers the overall EU Automotive Sector, and its value-chain.

The first release has provided a strategy and roadmap for Automotive Skills Agenda and its future developments complementary to other strategies in the sector. The second release aims at integrating, revising and eventually confirming such strategy so that it is always up-to-date and consistent with the main developments, current opportunities and challenges of the automotive sector; the update has been built on the same structure and content of the first one and presents, where appropriate, some key concepts and updates resulting from feedback received by a wide set of partners and stakeholders within the sector. This third and final release goes deep into the suggested Specific Actions part of the roadmap and offers a practical point of view for future implementation at regional level.

1.1 DEVELOPMENT AND RESEARCH ON INNOVATIVE VOCATIONAL EDUCATIONAL SKILLS PROJECT (DRIVES)

The Development and Research on Innovative Vocational Educational Skills project (DRIVES) delivers human capital solutions to the whole automotive supply chain through the establishment of an Automotive Sector Skills Alliance. This covers all levels of the value chain (research & innovation & development, vehicle production, automotive suppliers and automotive sales and aftermarket services). Through the network of all full project partners, namely ACEA, CLEPA and ETRMA, and associated partners, such as Stuttgart Region and Mangualde Municipality, DRIVES outcomes are disseminated EU-wide to more than 300 associations, bringing together more than 270,450 companies of all sizes, representing over 7 million workers.

The DRIVES project is part of the Blueprint for Sectoral Cooperation on Skills in the Automotive Sector.[4] The goal is to establish an Automotive Sector Skills Alliance covering all levels of the value chain and to ensure that needs of industry are reflected by education and training institutions. The Project is based on cooperation between 24 full partners from 11 EU countries[5]. The goals of the DRIVES project are to:

- **Analyse key trends** in the automotive sector, covering the whole value chain
- **Define the skills and job roles** needed in the future
- **Analyse the training offer side** currently available
- **Identify skills gaps** for foreseen changes
- Ensure **mutual recognition** of the skills and job roles **across the EU**
- **Create an EU-wide framework** that can be used throughout the EU and implemented in the EU regions – based on commonly used definitions
- **Create training** for selected skills and job roles in the automotive sector
- **Pilot 1100 learners across the EU** and across the education and training institutions
- **Provide clear guidance for the education and training providers** on skills needs of the automotive industry

More information about DRIVES project and contact: www.project-drives.eu

1.2 DOCUMENT OUTLINE

This document consists of the main following chapters and appendixes:

- **Chapter 1** provides an introduction to the project in terms of background and objectives;
- **Chapter 2 and 3** present the methodology and a summary of the key findings of the *first* release of the roadmap;
- **Chapter 4 and 5** present the methodology and a summary of the key findings of the *second* release of the roadmap;
- **Chapter 6 and 7** present the methodology and the key findings of the *third* release of the roadmap;

[4] https://ec.europa.eu/social/main.jsp?catId=1415&langId=en
[5] https://www.project-drives.eu/en/home

- **Chapter 8** outlines the final recommendations and next steps;
- **Appendix A** presents the details and tables of the methodological approach adopted as part of the *third* release of the roadmap;
- **Appendix B** contains the main details and outputs of the workshops held with automotive stakeholders at regional level. These workshops were the key component of the methodological approach adopted to carry out the *third* release of the roadmap;
- **Appendix C** provides an updated overview of the ongoing changes in the automotive sector;

2 METHODOLOGY FOR SECTORAL STRATEGY & ROADMAP (FIRST RELEASE)

The methodology applied for the sectoral strategy for the skills agenda in the automotive sector focuses on fulfilling the **mission**, **vision** and **values** defined in Figure 1.

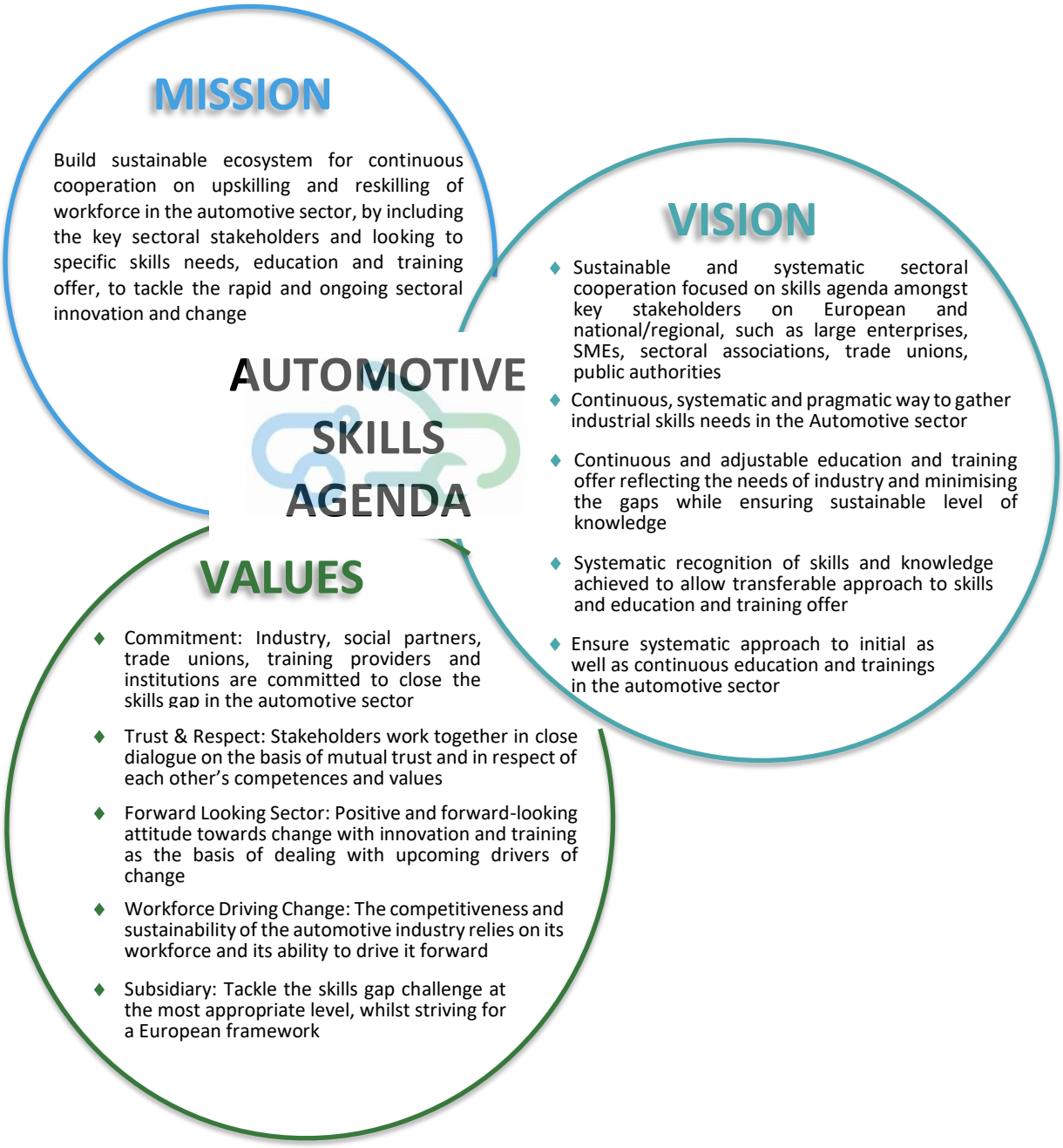

Figure 1 DRIVES project Mission, Vision and Values

The approach to the sector of the DRIVES project relating to the skills agenda that led to **the first release** of the strategy and roadmap can be summarised into the following content:

- **Key Areas of Skills Agenda** - the work was based on eight key areas[6] defined by the partnership. It served as the main elements for a sectoral strategy on skills and has been analysed one by one in order to permit a deep evaluation of each characteristic and evaluate specific actions.

- **Automotive Skills Agenda Analysis** - based on the defined Key areas, the DRIVES project carried out over last four years **Desk research, Survey focused on Skills needs and Survey focused on Skills offer**. It served as one of the inputs to the strategy: a funnel of information gathered by the desk-research activity, combined with direct engagement of stakeholders to support findings and recommendations included in the strategy and roadmap. Meetings and webinars were carried out with key European stakeholders to present previous outcomes and the main results and to collect first-hand feedback and opinions.

- **Automotive Skill Agenda Strategy** - DRIVES proposed an overall set of **Base Objectives** and **Specific Objectives** that served as the basis for a sectoral agenda skills strategy. On that basis we proposed **Key Actions (KA)**, with more detailed **Specific Activities (SA)**.

- **Automotive Skill Agenda Roadmap** – takes into the account the Key Actions identified and puts it to the perspective of the **Stakeholders** involved and **Timing.**

The creation (and update) of the roadmap follows a process described into Figure 2, where preliminary desk research analysis (D2.9.1 "PRELIMINARY STRATEGIC ANALYSIS") was conducted to investigate the current situation of the automotive sector. Such preliminary strategic analysis compared the outcomes of the European Automotive Skill Council[7] report and GEAR 2030 report[8] 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. Subsequently, a wider literature review was

[6] Key areas are described as follow: (i) Scope of the sector, (ii) Sectoral stakeholders, (iii) Drivers of Change influencing the sector, (iv) Target job roles and occupations, (v) Target skills, (vi) Training and education provision mechanisms, (vii) Recognition mechanisms, (viii) Recruitment and attractiveness of the sector, D2.9 "AUTOMOTIVE SKILLS STRATEGIC ROADMAP REPORT", DRIVES project
[7] European Sector Skill Council: Report, Eu Skill Council Automotive Industry, 2013
[8] GEAR 2030, High Level Group on the Competitiveness and Sustainable Growth of the Automotive Industry in the European Union, 2017

undertaken in order to validate, review and add new Drivers of Change to this initial list, and this analysis enabled the validation of the initial choice of Drivers of Change.

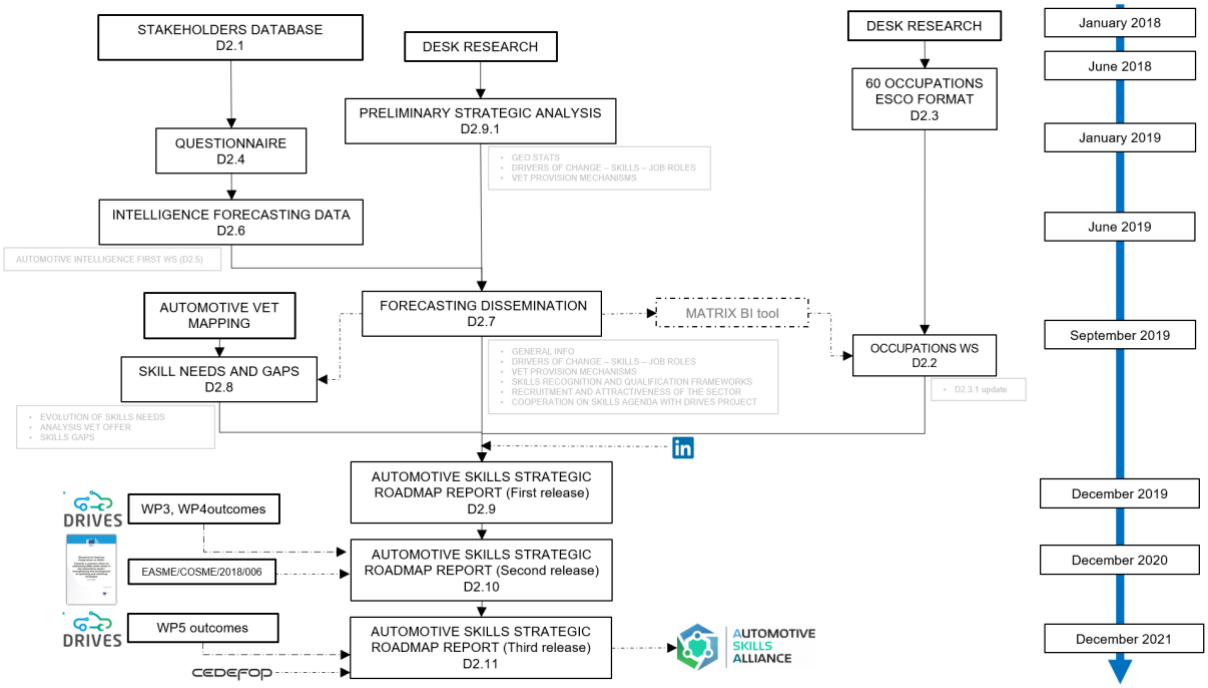

Figure 2: The sectorial skills and gaps update process of DRIVES WP2

As a next step, stakeholders were engaged through a survey (the so-called "Demand"[9] Survey). These results were presented to stakeholders during a workshop (D2.5 "AUTOMOTIVE INTELLIGENCE FIRST WORKSHOP") in order to have a final validation. The collected results were published into the Deliverable D2.6 "INTELLIGENCE FORECASTING DATA".

Using all the information collected from the preliminary desk research analysis and the intelligence forecasting data (demand survey and workshop validation) the final Demand point of view is represented by Deliverable D2.7 "FORECASTING DISSEMINATION".

In parallel, WP2 worked on a desk research analysis to collect a preliminary list of Automotive Occupation profiles (D2.3 "OCCUPATION PROFILE") and this list was merged with the results of the Job Roles and Skills section of the D2.7 "FORECASTING DISSEMINATION" report. These were presented during a specific workshop (D2.2 "OCCUPATION WORKSHOP") to automotive stakeholders and forwarded to WP3, WP4 and WP5 to support them in their specific activities.

[9] *The "Demand" survey identified the demand of skills and competences from a set of stakeholders (mainly companies)*

WP2 activities proceeded with an engagement of automotive VET providers, schools, universities and training centres to understand their offer of education. This was done through a new specific survey, (the so-called "Offer"[10] survey), which was based on the normalised output of deliverable D2.6 "INTELLIGENCE FORECASTING DATA" – the "Demand" point of view; in addition, WP2 started a cooperation with LinkedIn[11]: this allowed the project to obtain a set of queries from the automotive sector to support the strategic roadmap.

Merging together information, outcomes and results from previous Deliverables WP2 was able to create the deliverable D2.8 "SKILL NEEDS AND GAPS" that, for better readability of the data, the deliverable was divided into two documents:

- D2.8.1 "OFFER SKILL NEEDS": with only the "Offer" outcomes from the survey
- D2.8.2 "GAPS ANALYSIS": with a detailed analysis of the gap between "Demand" and "Offer"

The gap analysis outcome allowed the Partnership to design and create a sector RoadMap.

[10] *The "Offer" survey identifies the offer of skills and competences from a set of stakeholders (mainly VET providers)*
[11] *www.linkedin.com, July 2021*

3 CREATION OF THE ROADMAP

By leveraging on the partnership with LinkedIn and matching the information coming from the "Demand" and "Offer" point of view as indicated into Figure 2 D2.8 "SKILL NEEDS AND GAPS", WP2 identified the main sectoral gaps and prepared a set of recommendations used in the D2.9 "AUTOMOTIVE SKILLS STRATEGY & ROADMAP – FIRST RELEASE". As planned from the beginning, the project itself can generally fulfil its objectives and also generate project consortium envisioned pilot strategies as possible blueprints and solutions for future automotive domain skills needs with the respect of future possible European, national and regional follow-up solutions. All decisions are based on a complete vision of the sector from different points of view that:

- Ensure a constant view on the changing skills needs in the automotive sector: the "Demand" and "Offer" surveys have been created to engage automotive stakeholders and interact with them to obtain first-hand valuable information and matching them with desk-research activities. The partnership with LinkedIn has been useful to obtain their point-of-view on the sector.
- Aggregate and continuously update sectoral knowledge and intelligence: linking and merging all the deliverables outcomes together has been crucial to aggregate different source information in a row. The decision to use a business intelligence tool has been considered a great implementation to have a tool able to aggregate and receive/analyse updates in real time.
- Define and continuously update a strategic roadmap for skills in the automotive sector: with WP6 support the DRIVES project has consolidated a stakeholders Database (D2.1) always updated with information regarding stakeholders ready to cooperate with us. Their interaction, ensembled with LinkedIn partnership the BI tool and the development of activities of WP3, WP4 and WP5 with new possible stakeholders creating a yearly roadmap update as confirmed by the first release made during 2020. DRIVES entered also in contact with CEDEFOP[12]: the first proposal was to have a strong interaction during 2020. During 2021 a closer relation with the Automotive Skills Alliance (ASA)[13] is having a double benefit:
  - ASA partnership is supporting the roadmap update, as the Alliance gathers several automotive stakeholders and offers an easy and direct approach to them;

[12] *European Centre for the Development of Vocational Training (Cedefop) aim at improving vocational education and training (VET) through effective policy-making, https://www.cedefop.europa.eu/en*
[13] *Automotive Skills Alliance (ASA), brings together different kind of stakeholders involved in the Automotive ecosystem to ensure continuous, pragmatic and sustainable cooperation on the skills agenda in the ecosystem, https://automotive-skills-alliance.eu/*

- The roadmap update process at regional level, involving key regional actors (regional authorities, clusters, local industries) will support the Alliance in the offer of relevant inputs and needs.

- Provide advice to WP3, WP4 and WP5: all the Deliverables have been discussed with the different WPs. The presence of WP2 leader into WP3, WP4 and WP5 had simplified the communication and transferability of knowledge. Meanwhile at the beginning of the project WP2 gave inputs for other WPs, in this stage WPs are offering inputs to update the roadmap (e.g., WP2 is using WP5 best practices to inform regions about "how it is possible" to implement practical actions related to skills anticipation process).
- Develop a common methodology for assessing the current situation and anticipating future needs: a glossary and a matrix useful to share know-how between partners was created and shared during 2019. The DRIVES matrix (Occupations, description and skills according to ESCO[14]) was used to communicate the D2.3 (in 2018) and its updated D2.3.1 during 2019.

Based on the above-mentioned steps and Stakeholders' interactions, the Roadmap is the final result of an intensive gap analysis of the sector, from two different points of view:

- DEMAND of skills and competences generated by stakeholders who actively work and produce for the Automotive domain
- OFFER of skills and competences by stakeholders who produce training and courses (iVET and cVET) for the Automotive domain

The different vision of the sector between the "Demand" and "Offer" has been analysed through 4 main layers (by 2 different surveys):

- Drivers of Change, skills & job roles
- Training provision mechanisms
- Recognition and qualification frameworks
- Attractiveness (of the sector)

[14] *ESCO, https://ec.europa.eu/esco/portal, October 2021*

The gap analysis produces **8 main Key Actions** useful to close gaps, **detailed by 56 Specific Activities** as shown in Figure 3.

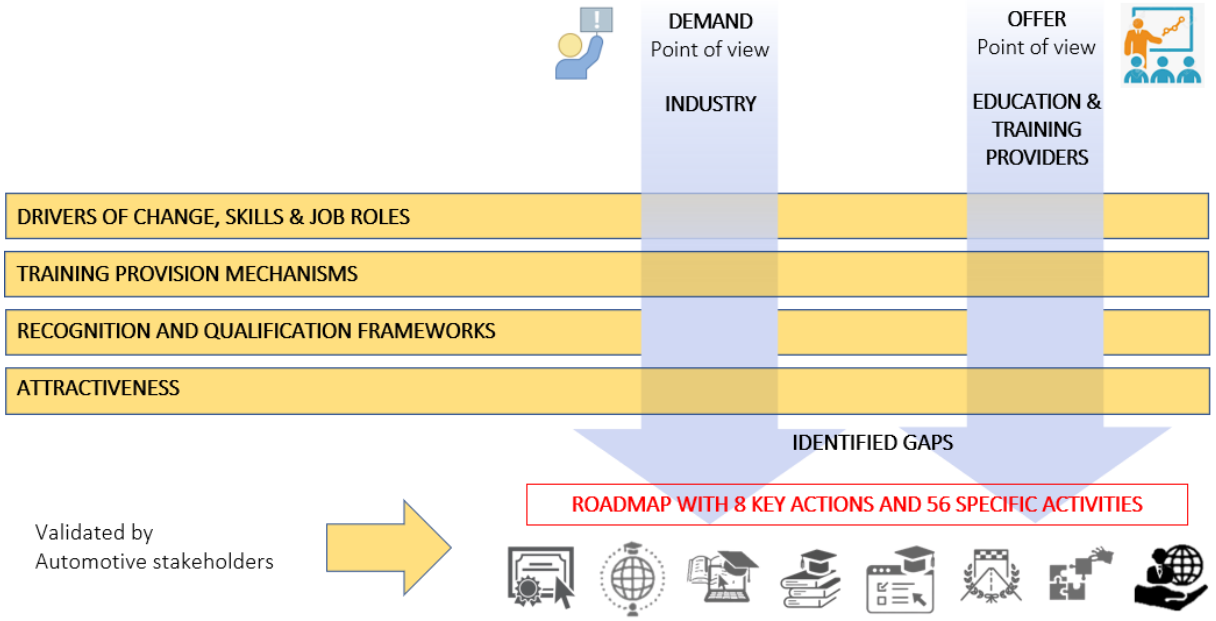

Figure 3: The RoadMap gap analysis process

Key Actions are the main actions to be taken to assure continuous and successful skills agenda in Automotive to tackle the ongoing changes. Each Key Action is described in further detail with a link to Specific Objectives, which needs to be justified with Rationales from Automotive Skill Agenda Analysis and available intelligence, and with specific and related Actions to be taken.

Based on the analysis, DRIVES proposes **Automotive Skills Agenda Strategy** with 8 **Key Actions** with **Specific Activities** (56) to be taken:

1. KA 1: Establish EU Reference Recognition of Skills and Job Roles
2. KA 2: Establish a Harmonised Approach to Education and Training Offer
3. KA 3: Understand and make available innovative methods of delivery of training and education
4. KA 4: Modular Approach to the Training Provision
5. KA 5: Focus on All Levels of Education and Training
6. KA 6: Improve Recruitment and Attractiveness of the Automotive Sector

7. KA 7: Actively Involve Key Players and Sectoral Intelligence Update
8. KA 8: Ensure Sustainable Approach

For each of the KAs, the **Automotive Skill Agenda Roadmap** has been proposed and takes into account the Key Actions identified and links it to the **Stakeholders** involved, assigning each of them a specific **Role** (key or supporting) and **Timing** (short/mid-term or continuous). In detail the 8 Key Actions are described in the paragraphs below.

3.1 KA 1: ESTABLISH EU REFERENCE RECOGNITION OF SKILLS AND JOB ROLES

The EU reference recognition of job roles and related skills is a key issue for a harmonised approach to recruitment, facilitate understanding of skills and job role needs, which enables more efficient upskilling and reskilling of the workforce through common and easy understanding of training and education needs. Framework will accelerate the process of training provision and enhance mobility of workers ensuring mutual recognition of the definitions across the EU within the automotive sector. The establishment of an EU-wide education and training Framework would facilitate the creation of a real pan-European marketplace and ensure future competitiveness of the European automotive industry[15].

At a minimum, it shall include a clear reference description of existing and new or emerging job roles in automotive sector and their related skills or competences and knowledge.

This will establish an intelligence service to track skills changes for employers and providers and act as an accessible resource for both employers and providers. It also allows a harmonised approach to skills and job roles awards and their recognition across EU automotive sector.

3.2 KA 2: ESTABLISH A HARMONISED APPROACH TO EDUCATION AND TRAINING OFFER

Harmonised baseline view of the key training and education providers and their courses offered towards the automotive sector, with respect to reference definition of job roles and their related skills. Education and training shall assure coverage of reference job roles and skills definitions. This will naturally bring about coverage of job roles and skills needs versus training and education offered.

[15] *"25 ACTION For a successful restart of the EU's automotive sector", ACEA, CECRA, CLEPA, ETRMA, May 2020*

A database of key providers and their training courses shall be developed for the automotive sector throughout the value chain ensuring quality standards for the entrants and enable competition between the training providers across the EU.

It should also enable comparison of the training offer serving the automotive sector in different skill areas and in different nations.

This should also have positive spill-over effect to push non-recognised/non-participating regional/local education providers to be part of the EU system and safeguard firstly their training offers to the automotive value chain in their home region, secondly provide “export opportunities” for their training to other parts of the EU.

3.3 KA 3: UNDERSTAND AND MAKE AVAILABLE INNOVATIVE METHODS OF DELIVERY OF TRAINING AND EDUCATION

Develop and share methods for mapping training provision serving the automotive sector at all levels - At the moment there is no clear view of the range of training provision currently serving the EU automotive sector. In order to identify weaknesses and gaps in current provision we need to understand in more detail what provision currently exists and what is demanded from the industry side. It includes identification and support of innovative training and education methods such virtual reality or online/blended training courses, to tackle the needs of off-site training as well as the identification and support of training on the job methods and approaches.

There shall be a centralised resource with examples of good practice. This could be set up as a vehicle for gathering good practice in relation to particular examples of training, tackling recruitment difficulties etc. A range of easily accessible examples of particular relevance to the automotive sector located on one site would provide a valuable resource for employers, providers and others involved in trying to develop training (including apprenticeships) in order to meet the fast-changing requirements of the sector. This could draw on a wide range of existing documented good practice, which could be the basis for communication campaigns to ensure the sector is informed and can draw from these.

3.4 KA 4: MODULAR APPROACH TO THE TRAINING PROVISION

In order to respond to fast changing skill requirements more flexibility is required in how training provision is designed and delivered. Many employees and employers do not require full training courses but need to focus on particular gaps/weaknesses in current individual/workforce skills and competences. Making it easier to top-up these specific skills would encourage existing employees to participate in training. This would help SME’s (which are typically highly specialized) to make efficient

use of training costs and facilitate the release of employees for such training. It would also support much more flexible career pathways.

3.5 KA 5: FOCUS ON ALL LEVELS OF EDUCATION AND TRAINING

The critical mass of the employees and workers have lower than tertiary level of education – their continuous upskilling and re-skilling is therefore critical. The education and training providers should also enable clear up-skilling paths for the lower skilled employees toward higher education levels.

The more complex structure of the workforce in the automotive industry must also be reflected in the much broader scope of the education and training provided by the providers.

That also means that the target groups of the education providers must be much broader, including:

- Post-graduate institutes to offer high level education and training for the highest skilled workforce in the automotive (often very specialised one)
- Universities providing new curricula for different levels of tertiary education
- VET providers covering wide range of training focusing on upskilling and re-skilling courses to ensure continuous training for the workforce in the automotive sector, which is key and necessary for the foreseen structural changes
- Apprenticeships – covering critical mass of the employment in the automotive sector (often seen as a fundamental "workforce input" to the employment in the sector), combined with the VET providers to ensure continuous upskilling of the entrants to the labour market

All those levels should be aligned with the needs of industry with regards to the methods of delivering the training or education, such as training off the job, online training, virtual reality, and so on.

3.6 KA 6: IMPROVE RECRUITMENT AND ATTRACTIVENESS OF THE AUTOMOTIVE SECTOR

The Skills Agenda is closely linked to recruitment, which is influenced also by the attractiveness of the Automotive sector. The sector must be attractive for young talented potential employees as well as for all possible workers. The key issues are to identify the challenges and possible methods to further support of attractiveness of the sector.

3.7 KA 7: ACTIVELY INVOLVE KEY PLAYERS AND SECTORAL INTELLIGENCE UPDATE

Overall active cooperation between the key stakeholders is an issue for the development and update of the skills agenda in the Automotive sector. It consists of international stakeholders, as well as

national and regional stakeholders. There must be the same understanding of the skills agenda and its commonalities as well as specifics on national and regional levels. There must be an overall understanding and commitment to actively support the identification and update of Sectoral Intelligence in Automotive Skills Agenda, such as skills needs, training offer, and so on.

EU and the national/regional aspect must be taken into account. The regional aspects of education and training should be further explored within the scope of the Automotive Skills Agenda, possibly through pilot projects for the implementation of the EU framework.

As already indicated, the regional level actions seem to be critical to mitigate foreseen structural changes. This will have implications on the education and training system and education and training providers as well, which must be implemented regionally/locally to tackle specific problems of the given regional cluster. The actions at the local, and even company-level, should be supported and endorsed by relevant tools (fiscal and other financial incentives as well) on the national and EU level.

3.8 KA 8: ENSURE SUSTAINABLE APPROACH

The EU Framework should be implemented through the EU Automotive Skills Alliance acting as the umbrella body for sectoral skills agenda, established under the sectoral Skills Pacts. It should represent the implementing body for the EU education and training providers in the automotive sector.

The Alliance should follow the mission, vision, values and ideas and should focus on the specifics of Skills Agenda in Automotive sector defined by this strategy, such as:

- Providing overall skills and job roles definitions applicable across the EU with respect to the automotive sector.
- Providing assessment and ensure high quality level for the training provided on the EU level
- Providing quality rules for the training providers allowing entry into the EU-wide level database of VET and training providers.
- Assessing the development of the skills needed in the automotive sector on a regular basis.
- Sharing good practice towards creating an EU automotive sector apprenticeship market, understanding and promoting the apprenticeship marketplace and managing online EU apprenticeship recruitment tool.
- EU Automotive Skills Alliance should ensure constant contact with stakeholders to follow-up and update trends and definitions/qualitative criteria to enter the system. In principle the Alliance should set up a system of “working groups” where different tasks will be discussed and provide an upgrade on a continuous basis.

- The upgrade should be based on in-depth analytical feedback from stakeholders in the automotive sector, such as the industry, training and educational providers (VET, academia) and expertise from the Commission, member states and regional authorities.
- This structure will also allow outputs from other Blueprints (e.g., ALBATTS[16]) or other projects that are currently running.

It would also allow a spill-over of the system to other sectors, provided sufficient inputs from industry, education providers and policy-makers on EU and national levels.

[16] https://www.project-albatts.eu/, *ALBATTS Project, November 2021*

4 METHODOLOGY FOR SECOND RELEASE OF THE ROADMAP

For the purpose of the second update, each Key Action has been put under the attention of several stakeholders of the sector to investigate their relevance and consistency –taking into consideration the detailed Actions to be done for each KA, and if any revisions of their strategic approach were necessary.

The Key Actions updated were followed also by a desk research process based on European running projects and initiatives in the Automotive sector (It is valuable to underline some results of the COSME project[17] focused specifically on SMEs skills needs in the Automotive sector); in terms of interaction with stakeholders, DRIVES partnership took into consideration the results and outcomes from WP3 and WP4 DRIVES partners. Specific Workshops were organised to present DRIVES results and collect feedback using instant poll tools to gather feedback from automotive stakeholders as well as dedicated one-to-one meetings with umbrella organisations (ACEA, CLEPA, ETRMA and CONFINDUSTRIA/SFC).

4.1 ROADMAP SECOND RELEASE: RESULTS

Based on Figure 2, the second release of the roadmap D2.10 "AUTOMOTIVE SKILLS STRATEGIC ROADMAP REPORT – SECOND RELEASE" took into consideration the feedback received during a systematic interaction with the DRIVES Partnership, stakeholders and also a comparison with main results from other relevant projects focused on the automotive skills agenda.

The collected feedback was compared with the roadmap's results Deliverable D2.9 "AUTOMOTIVE SKILLS STRATEGY & ROADMAP – FIRST RELEASE". The results were incorporated into the second release of the roadmap and represent a confirmation of the activities carried out by DRIVES partners during the first 3 years of the project.

As a general observation, stakeholders reported that the Key Actions are still valid and their implementation is still crucial, with no key modifications to be done. In particular, it was possible to rank the most urgent actions as perceived by stakeholders:

- Build a common dialogue platform to inform companies and VET providers about the different needs and create a common vision for the future;
- Establish the Automotive Skills Alliance;

[17] *Towards a common vision on addressing SMEs skills needs in the automotive sector: strengthening the development of upskilling and reskilling strategies, EY and Fondazione Giacomo Brodolini, 2020*

- Define and assure financial sustainability of the alliance;
- Support the implementation of the Key Actions;
- Ensure overall sustainable support from key stakeholders;
- Create links between automotive businesses and VET providers for widespread sharing of the results of intelligence update outcomes;
- Act as a platform for the Automotive Skills Agenda and stimulate its continuous development;
- Harmonise a set of areas and base and specific objectives that will reflect all elements of the skills agenda.

The collected feedback is presented in the following paragraphs according to each Key Action.

4.2 KA 1: ESTABLISH EU REFERENCE RECOGNITION OF SKILLS AND JOB ROLES

The current lack of transparency in terms of skills and qualifications as well as a coherent and up-to-date overview of information on skills needs in Europe is perceived as an issue by the majority of the stakeholders who took part in this exercise. This point of view is also confirmed by PwC into the COSME project[18], where "There is a vast number of initiatives spread all over the EU either lead by public, private or in the form of partnerships. The problem is not the lack of initiatives, but mainly the lack of coordination and coherence between all existing strategies and initiatives – vertically and horizontally."

4.3 KA 2: ESTABLISH HARMONISED APPROACH TO EDUCATION AND TRAINING OFFER

It is important from the perspective of stakeholders to have a harmonised baseline view of sectoral trainings and education providers across the EU, since it is generally perceived as difficult to navigate and compare the training offered across the different levels in the EU. With the intention of going deeper into the practical actions to be taken to fill the gaps and achieve the goals of Key Action 2, the stakeholders voted on a series of proposals where it emerged that for all of them "establish a system to share resources / good practices to address skill gaps and challenges", "establish an EU-wide

[18] *Skills for Industry: Skills for Smart Industrial Specialisation and Digital Transformation (COSME), PwC, 2020*

database of education providers" and "identify and map key training gaps/weaknesses" are the priorities.

4.4 KA 3: UNDERSTAND AND MAKE AVAILABLE INNOVATIVE METHODS OF DELIVERY OF TRAINING AND EDUCATION

It has been confirmed by stakeholders that the need of innovative training and education methods across the EU are effectively mapped. The idea of a centralised resource gathering good practices of particular examples of training would be a benefit for the whole sector. At the same time, stakeholders agreed the importance of continuous alignment between industry and VET providers for the identification of the most suitable, efficient and effective training delivery methods and in different moments during the roadmap update stakeholders highlighted the necessity of having a centralised repository of good practices of particular examples of training.

4.5 KA 4: MODULAR APPROACH TO THE TRAINING PROVISION

As evidenced by the report of the Executive Agency for Small and Medium-sized Enterprises (EASME)[19], future skill demand will consist of a mix of existing and emerging skills linked to new technologies. The need to have more modular and flexible training courses to adapt to the skills needs of the sector is therefore crucial, but it is still an issue for stakeholders where a modular approach to training can facilitate the identification of the right mix of skills of the individual for a specific career pathway. More effort shall be put on the analysis of the skills needed by the different employees of a specific organization, with constant consultation with education and training providers in order to design and propose more modular and flexible training. Analysing other projects running in the automotive sector[20], it has also been highlighted those successful initiatives to address the training approach combine private and public funding, where private and academic partners also contribute non-financially (knowledge and materials). In general, these are industry-led approaches and it is evident the importance of dual-track education from a lifelong learning perspective, which is seen as the key instrument in bridging the skills gap.

[19] *EASME/COSME/2018/006: EY, Fondazione Brodolini, 2020, "Blueprint for sectoral cooperation on skills - Towards a common vision on addressing SMEs skills needs in the automotive sector: strengthening the development of upskilling and reskilling strategies"*
[20] *Skills for Industry: Skills for Smart Industrial Specialisation and Digital Transformation (COSME), PwC, 2020*

4.6 KA 5: FOCUS ON ALL LEVELS OF EDUCATION AND TRAINING

Complementary to modularity and flexibility, stakeholders generally agree on a training and education offer that is much broader (thus encompassing all levels of education) for a proper up/reskilling of employees. In this regard, drawing on examples of good practices at regional, national and EU level that have developed specific training and programmes targeting workers with different levels of skills is perceived as the most useful approach for stakeholders wishing to implement or support such activities. This is supported by the result of the direct interaction with stakeholders during the second release of the Roadmap update.

4.7 KA 6: IMPROVE RECRUITMENT AND ATTRACTIVENESS OF THE AUTOMOTIVE SECTOR

Based on feedback received by engaged stakeholders during the strategy and roadmap update process, 5 main actions have been ranked to improve the attractiveness of the sector:

- Develop initiatives in connection with guidance for young people as well as teachers and families;
- Carry out targeted outreach initiatives to promote its attractiveness among youngsters and professionals from other sectors;
- Foster communication actions to disseminate modern automotive job profiles;
- Develop a clear “career path forecast”;
- Conduct specific EU-wide communication campaigns and HR policies targeting each specific group of workers.

Attracting and recruiting are similarly important for stakeholders, even if this is not considered as the most crucial issue to be tackled by all of them. However, we also evidence in the recent analysis on labour market trends of the Executive Agency for Small and Medium-sized Enterprises (EASME)[21] that the sector is facing shortage on suitable workers both in terms of qualitative and quantitative terms;

[21] *EASME/COSME/2018/006): EY, Fondazione Brodolini, 2020, “Blueprint for sectoral cooperation on skills - Towards a common vision on addressing SMEs skills needs in the automotive sector: strengthening the development of upskilling and reskilling strategies”*

and that the workforce remains relatively old and the sector has limited attractiveness among young generations.

4.8 KA 7: ACTIVELY INVOLVE KEY PLAYERS AND SECTORAL INTELLIGENCE UPDATE

All stakeholders engaged believe in the necessity of strengthening the level of collaboration at EU level, with the aim to have a general and harmonised main guideline. However, immediately after this level, stakeholders point out the necessity to go into a national level, reinforcing the concept that Europe is made of several countries with their own issues. To this end, “creating communities of practice to be updated on innovative approaches and changing skill needs”, “hosting workshops, groups and events involving a wide range of stakeholders” and having a “continuous data sharing and communication” are particularly encouraged.

4.9 KA 8: ENSURE SUSTAINABLE APPROACH

Stakeholders generally agree that all the Key Actions cover and represent the urgent and important issues to be addressed in their organization and more generally in the sector as a whole.

5 METHODOLOGY FOR THIRD (AND FINAL) RELEASE OF THE ROADMAP

The objective of this third and final release is to further enrich the roadmap with **information and best practices that can help the wider automotive community translate the strategy outlined in the roadmap** (first and second release) **into a set of practical and operational actions for implementation**.

To do this, as shown into Figure 2, DRIVES Partnership engaged and involved regional automotive clusters stakeholders through workshops. This activity was supported by:

- Analysis and research of best practices across the EU: these were collected thanks to the support of WP5 – which has identified best practices already in place across the EU through the *Good Practice Resource Tool*[22]. The tool collects examples of good or innovative practices in the automotive sector (with a specific focus on apprenticeship) in the form of case studies[23].
- Analysis and research conducted within the work of the Automotive Skills Alliance (ASA)[24]. In particular, ASA partnerships within Working Group 4 (WG4) helped to better frame the 4 topics which are presented below and that are the key component of this third release of the roadmap.

Both above approaches are described in detail in APPENDIX A – DETAILED METHODOLOGY FOR THE THIRD RELEASE.

5.1 ROADMAP THIRD (AND FINAL) RELEASE: RESULTS

As the sectoral intelligence process was organised into 8 Key Actions and 56 Specific Actions – and the second release was focused more on the validation of the 8 main Key Actions, this final release is based on the gaps highlighted between «Demand» and «Offer to **search for successful best practices that could serve as the translation of the Key Actions on a practical level.**

To do this, a **matching exercise** was carried out between the 56 Specific Actions and the best practices identified with the support of WP5 under the Good Practice Resource Tool[25]. The matching process led

[22] https://drives-compass.eu/en/home, *November 2021*
[23] *The Good Practice Resource Tool is available at* https://drives-compass.eu/home
[24] https://automotive-skills-alliance.eu/, *October 2021*
[25] *The Good Practice Resource Tool is available at* https://drives-compass.eu/home

almost to a one-to-one correspondence between each best practice and each Specific Action (although some best practices were actually applicable to more than one Specific Action).

Subsequently, the 56 Specific Actions and associated best practices were grouped under **4 main topics**. These 4 main topics were also validated and integrated thanks to the work and feedback from the partnership of the Automotive Skills Alliance WG4 (for a more detailed analysis of this process, please refer to APPENDIX A – DETAILED METHODOLOGY FOR THE THIRD RELEASE).

These are:

1. STANDARD DEFINITION

How to:

- Provide a reference definition of skills and job roles relevant for automotive-mobility ecosystem
- Establish a common methodology to the harmonisation of skills ontology in order to facilitate identification and description of skills
- Provide unified and harmonised databases and information resources of skills and job roles to allow easy comparison
- Adopt the reference framework by the key stakeholders

2. FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS

How to:

- Establish or connect with skills domain groups of industry experts tasked with updating new and emerging job roles and skills
- Consolidate an active automotive community focused on skills with relevant participation of stakeholders, with particular reference to companies, national associations, VET providers and regional authorities
- Organise events aimed at facilitating exchange between key stakeholders
- Provide the platform to access to the relevant information

3. INTELLIGENCE

How to:

- Present trends and future foresight to education and training providers for a better vision of future needs and possible changes

- Provide easily accessible data reflecting the current situation of the sector
- Update existing curricula to address the challenges and skills changes
- Evaluate current challenges affecting the sector

4. TRAINING PROGRAMMES

How to:

- Develop specific training activities/programmes for workers with lower level of skills to upgrade their skills and create clear progression pathways between different training levels
- Stimulate preparation of new modular training and education plans and curriculum
- Develop initiatives in connection with guidance for young people as well as teachers and families
- Set up training programmes with train- the-trainers approach focused to technical skills, digital skills and soft skills

5.2 REGIONAL WORKSHOPS: MAIN OUTCOMES AND NEEDS

The 4 main topics (which emerged after the matching of the 56 Specific Activities with the best practice) were presented to automotive regional stakeholders thanks to dedicated workshops held online in the following countries**: Germany, Italy, Poland, Portugal, Romania and Spain**.

The workshops allowed a further practical deep-dive into the search and validation of successful practices that could serve as the translation of the Key Actions on a more practical level.

In particular, for each of the 4 main topics, 2 best practices previously identified were chosen as best examples to be presented to automotive regional stakeholders (chosen best practices are described in detail in B.3 RESULTS FOR EACH REGION).

During the meetings, WP2 asked participants the following main question:

"Are similar best practices – like the ones we showed to you:

- *Already successfully in place in your region?*
- *Not implemented in your region but potentially interesting?*

- *Not relevant for your region? And if so, are there other themes that shall be addressed that we have not covered?"* [26]

Feedback from participants of the workshops is presented in an aggregated form below according to each topic.

1. STANDARD DEFINITION

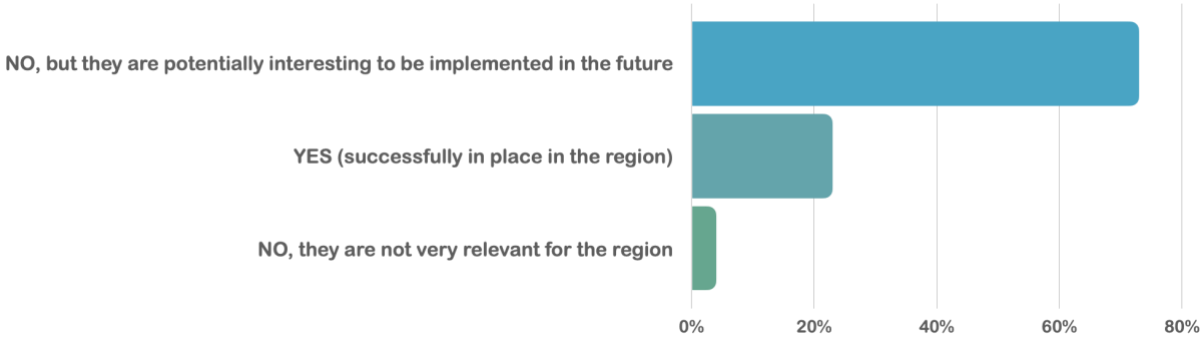

Figure 4: Standard Definition - feedback

Of the voting participants among the countries, 73% stated that the topic of standard definition has currently no similar best practices that are implemented. This was also stated and agreed by the participants of the workshop in Germany[27], who stressed the fact that there are standard definition problems at national level (especially between schools and training steps and the labour market).

With reference to Poland, participants stated that best practices are somehow represented in Poland but not on a big scale, therefore these examples can be an incentive to be more widely used.

[26] *Questions were asked through an instant poll platform: www.mentimeter.com*
[27] *The workshop in Germany was attended by a restrictive number of participants, therefore WP2 did not use an instant poll platform to extract results in the form of graphics, but rather topics were discussed openly during the workshop.*

2. FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS

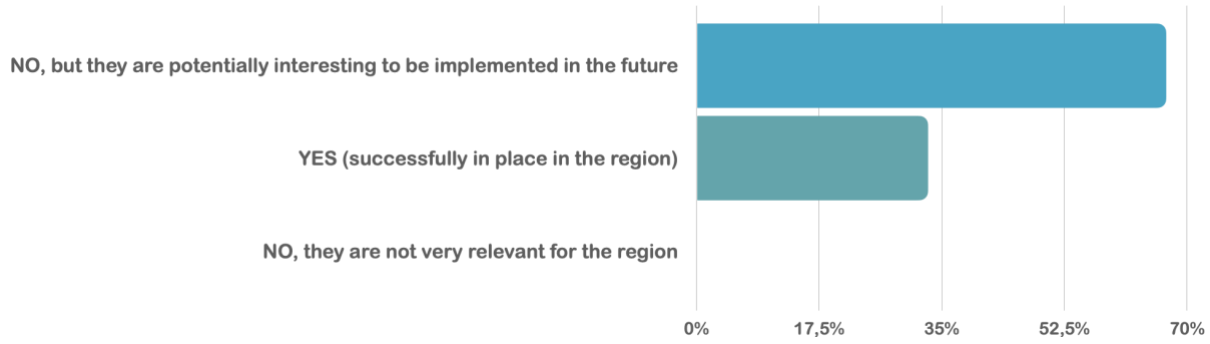

Figure 5: Facilitating encounters between different stakeholders - feedback

67% of participants stated that the topic "Facilitating encounters between different stakeholders" is not currently implemented, whereas 33% confirm that these kinds of best practices are currently ongoing.

Of great importance is pushing for the creation and/or consolidation of a leading institution, such as sectoral council for skills for automotive industry.

3. INTELLIGENCE

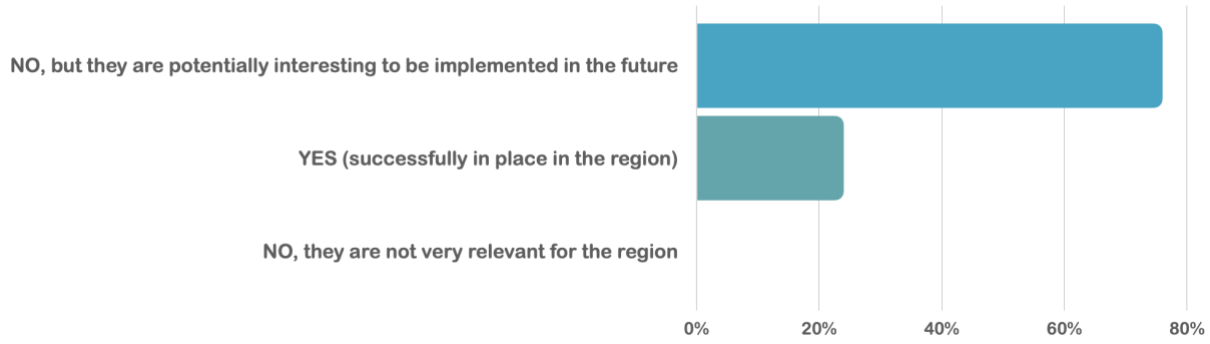

Figure 6: Intelligence - feedback

With reference to intelligence, 78% participants among the countries stated that this topic is not widely implemented, but potentially interesting for the future. In particular, the job roles identified in the process of the roadmap creation were considered by participants as a very good starting point, as they allow the definition of some core elements that can be standardised and more widely used.

4. TRAINING PROGRAMMES

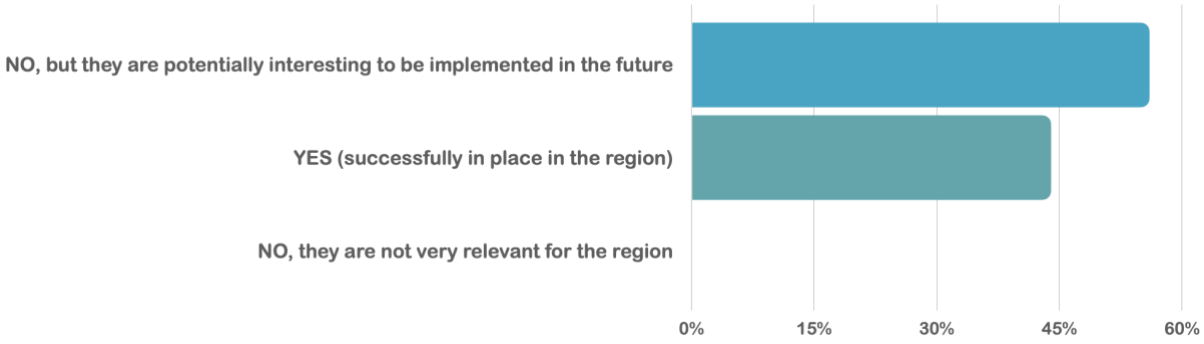

Figure 7: Training programmes - feedback

Regarding training programmes, responses are more balanced with 56% of people stating that similar practices are not currently implemented. Their major concern regarding training is that very often workers do not see the need to work on skills development, both in the form of up and reskilling. Particularly in Spain, it has been evidenced that reskilling is sometimes even more difficult than upskilling: reasons may relate to higher costs of reskilling or simply the little focus put on lifelong learning.

All countries agree on the fact that courses and trainings must be more modular, short and flexible (e.g., on-line/on-site/hybrid).

5. RANKING THE 4 MAIN TOPICS

When aggregating all results together, it is possible to have a ranking of the topics to see which one is perceived as most important and relevant to implement. This is shown in Figure 8:

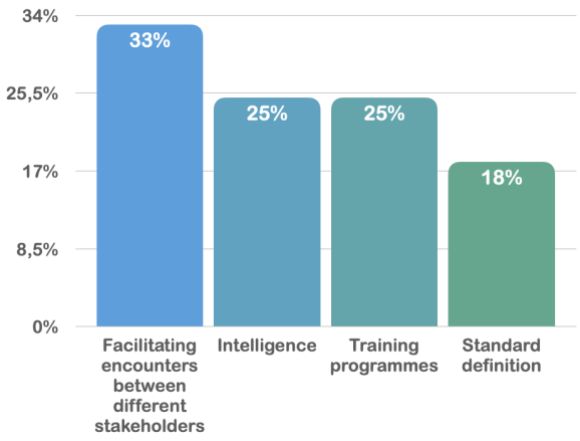

Figure 8: Most important and relevant topics as voted by participants of the regional workshops

5.3 RECOMMENDATIONS AND NEXT STEPS

The outcomes of the third release of the roadmap – combined with those of the second and first could serve as an input for the Automotive Skills Alliance to use all the knowledge collected during the 4 years of DRIVES project as a practical base for the Automotive domain.

First, the regional aspect of the education and training is of extreme importance. The link between regional education and the regional labour market is critical. Moreover, the need to strengthen links with those regions with the most significant clusters of automotive activity is essential in order to support:

- Mapping of existing provision
- Identification of gaps/weaknesses in provision
- Identify changing skill needs and implications for learning support
- Mapping the available financial resources

Generally speaking, a strong collaboration towards new common standards of production of semi-finished products, components and finished products at every level of the automotive supply chain is mandatory to remain competitive, and investing in intelligent and flexible solutions for the benefit of all the involved stakeholders by exploiting the so-called "industry 4.0" is a solution (see Appendix C.7 INDUSTRY 4.0 INTO AUTOMOTIVE SUPPLY CHAIN for more details). “Facilitating encounters between different stakeholders” is the starting point for this solution.

The backbone for success is driven by Big Data information and the use of Business Intelligence tools as underlined by regional workshops outcomes with the “intelligence” reply (se Figure 8). Offering to stakeholders involved a set of common data, forecast and sector insights allows stakeholders to concentrate themselves into “next steps” instead of “what happens” and moreover, supports a common understanding of the automotive sector direction (Macrotrends[28], Trend and Drivers of Change).

Also confirmed by recent research[29]- which highlights how the rapid pace of technological change demands more modular and flexible training courses, the introduction of modular and/or unitised training structures[30] allows for easier updating of qualifications to incorporate new technologies or

[28] *Megatrends: Ten New Directions Transforming Our Lives, Naisbitt John, 1982*
[29] *Manufacturing the future workforce; High Value Manufacturing (HVM) Catapult, November 2019*
[30] *The role of modularisation and unitisation in vocational education and training, CEDEFOP, 2015*

ways of working, and this is a priority for stakeholders involved in regionals workshops as per the "training programmes" replies as shown in Figure 8.

Finally, also according to Figure 8, there is a clear need to harmonise information ("standard definition") because many training and education providers exist at a regional/national and EU level. Although various associations focus on different levels of training and education, it is challenging to have overall view of the offer and this was also clearly visible thanks to the "Offer" survey run by DRIVES project, where it was very difficult to map the existing courses and education providers that are related to automotive sector. It is also hard to compare the specific training offer by skill area and between nations, as well as define training courses and how they relate to each job role and skill.

The automotive industry invests heavily in new technologies and creates the new product portfolios needed to achieve smart, safe, and sustainable mobility. Therefore, a need for re-skilling and upskilling of the workforce became more important than ever and the time is of the essence. Europe needs to move rapidly, exploiting its strengths in innovation at all levels and in all sectors of the future mobility and transport systems to remain at the forefront. Only by working together and involving all the relevant actors, including education, the industry can face the future within an increasingly competitive global market. At the same time, a global market such as ours, requires increased international cooperation. This is key, particularly with regard to regulatory cooperation on the framework conditions, defining technical regulations, and setting standards.

To the already challenging climate and digital transition, the automotive industry is now facing a disruption on the supply chains.

Currently, the transition to electromobility is putting several jobs at risks, mainly those dependants on the internal combustion engine technology. The value added that comes with the new technologies (batteries) does not compensate for the losses identified with the sector transformation. In a recent study 'Electric Vehicle Impact Assessment Report 2020-2040: A quantitative forecast of employment trends at automotive suppliers' finding[31] indicate that the current proposed legislation on co_2 emission targets would put 501.000 jobs in the powertrain domain at risks until 2040, and these losses would incur in just a 5-year period, between 2030 and 2035. The production of battery electric vehicles will create new employment opportunities, but overall is less labour intensive and this requires a different skill set to make those new jobs happening, that may, in any case, be created

[31] *https://clepa.eu/who-and-what-we-represent/ev-transition-impact-assessment/*, CLEPA, 2021

elsewhere. Is therefore critical to invest in the upskilling and reskilling od the sector to minimise, where possible, these losses.

The drive towards sustainable and smart mobility has consequences throughout the automotive value chain, including in the replacement/aftermarket. This is particularly visible in the case of tyres, which are becoming increasingly connected, sustainable and safer. This has brought to considerable transformations in the tyres abilities and performances, the sector's business model, the production process as well as to the skills that are needed to drive such change.

Products with increasingly ambitious performances require additional skills to be added even to existing and more traditional work profiles. This is particularly true in the domain of circular economy and the efforts of the industry towards closing the loop.

In terms of "smart mobility", tyres are also becoming increasingly connected. Through the concept of tyre-as-a-service, data coming from the interaction of the tyre with its environment (e.g., road) and the vehicle can optimize the tyre selection according to specific usage conditions and by this, reducing emergency repairs and total cost of ownership. Services can also include infrastructure quality management, as advanced information can be made available to drivers and authorities of road conditions, air quality, danger zones and traffic flow. Other applications go in the direction of integration of tyre data with other fleet information like fuel consumption, electrical charge etc. contributing to the optimization of transport and reduction CO_2 emissions. Digitalisation also involves the production process.

In terms of employment, the digitalisation and evolution of the automotive eco-system has consequences at all levels of the business:

- Management: strategic, managerial, and soft skills are of the essence and need to be applied to a more challenging environment that takes into account not only the short-term bottom line, but the long-term balance of profits and sustainability in a constantly changing social-economic environment. Furthermore, with the digitisation and globalisation of the production process, there is the need to be able to manage cross-skilled teams, often coming from different cultures and ways of life. Finally, who says "digital" says "data" – lots of it – and managers are increasingly required to be able to identify which of it is of importance and how to translate it into an actionable item.
- Shop floor: with the shift towards "smart factories" machine operators will no longer be required to operate those machines, but rather they will be required to focus on trouble

shooting, shifting the focus of the skills from manual to cognitive, operating computers and could be required to even write code.

APPENDIX A – DETAILED METHODOLOGY FOR THE THIRD RELEASE

A.1 56 SPECIFIC ACTIONS MATCHED WITH BEST PRACTICES AND GROUPED INTO 4 MAIN TOPICS

The following Table 1 shows the matching of each Specific Action with good practices[32] resulting in the 4 main topics mapped with DRIVES WP5 support.

Table 1: Specific Activities, Main Topics and Good Practices

CODE	MAIN TOPIC	SPECIFIC ACTIVITIES	GOOD PRACTICE
KA 1-1.1	STANDARD DEFINITION	1.1. Define the importance of national/regional standards definitions and the rules for their recognition within EU ontology	Dual Certification, Degree Apprenticeships, Basque Industry 4.0 Strategy, Cedefop European Database on Apprenticeship Schemes
KA 1-1.2	STANDARD DEFINITION	1.2. Define and assure coherence with ESCO definition	Basque Industry 4.0 Strategy
KA 1-2.1	STANDARD DEFINITION	2.1. Establish a common methodology to the harmonisation of skills ontology in order to facilitate identification and description of skills	Dual Certification, Cedefop European Database on Apprenticeship Schemes
KA 1-2.2	STANDARD DEFINITION	2.2. Establish a common methodology to the harmonisation of job roles ontology in order to facilitate identification and description of job roles	Cedefop European Database on Apprenticeship Schemes
KA 1-4	STANDARD DEFINITION	4. Adoption of the reference framework by the key stakeholders, including large, medium and small industry	Basque Industry 4.0 Strategy, Cedefop European Database on Apprenticeship Schemes
KA 1-2.3	STANDARD DEFINITION	2.3. Establish framework that functions an intermediary body facilitating encounters between different stakeholders	Cedefop European Database on Apprenticeship Schemes
KA 1-3.2	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	3.2. Establish or connect with skills domain groups of industry experts tasked with updating new and emerging job roles	High Value Manufacturing Catapult – Skills Foresighting Process, Skills Escalator, MERINOVA Digitalisation Academy, Basque Industry 4.0 Strategy, Dual Training
KA 7-7.1	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	7.1. Create “skills domains working groups” among (as minimum) VET providers and industry representatives to focus on the analysis of drivers of change and their consequences on VET evolution	Dual Certification, Dual Training
KA 7-7.2	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	7.2. Promote discussion within the “domains working groups” on the evolution of job roles and its consequences on VET and training, VET provision mechanisms and their	MERINOVA Digitalisation Academy, z.l.ö. - zukunft.lehre.österreich

[32] https://drives-compass.eu/en/home, *November 2021*

CODE	MAIN TOPIC	SPECIFIC ACTIVITIES	GOOD PRACTICE
		effectiveness for industrial stakeholders, skills recognition	
KA 7-7.3	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	7.3. Promote discussion within the "domains working groups" on the evolution of the sector, its technologies and drivers of change	High Value Manufacturing Catapult – Skills Foresighting Process, MERINOVA Digitalisation Academy, STEM Talent Girl Program
KA 7-8.2	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	8.2. Ensure the feasibility of the activities listed in this Roadmap through the involvement of regional, national and EU institutions – this support should include also financial resources.	z.l.ö. - zukunft.lehre.österreich, JA3B
KA 8-1	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	1. Establish Automotive Skills Alliance	z.l.ö. - zukunft.lehre.österreich, JA3B
KA 1-3.4	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	3.4. Work with research think tanks and data collection agencies focused on skills mapping	High Value Manufacturing Catapult – Skills Foresighting Process, Cedefop European Database on Apprenticeship Schemes
KA 1-3.5	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	3.5. Utilise existing automotive employer groups established at national and regional level together with national centres of expertise to undertake more detailed consultation on changing skill requirements	High Value Manufacturing Catapult – Skills Foresighting Process, Basque Industry 4.0 Strategy
KA 2-3.1	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	3.1. Bring VET providers closer to understand needs and develop appropriate learning outcomes	Car Mechatronic Learning Path, High Value Manufacturing Catapult – Skills Foresighting Process, Skills Escalator, Dual Certification, Automotive Technology - Level 5, AVL System Engineering Labour, MERINOVA Digitalisation Academy, Dual Training
KA 2-3.3	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	3.3. Establish a systematic communications system between VET and automotive partners on the evolution of skills and their consequences on VET and training	Car Mechatronic Learning Path, High Value Manufacturing Catapult – Skills Foresighting Process, Skills Escalator, Dual Certification, Automotive Technology - Level 5, MERINOVA Digitalisation Academy, TU Graz Life Long Learning, JA3B, Dual Training
KA 3-1.2	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	1.2. Communicate broadly to VET providers the needs of industry in regards to preferred VET provision mechanisms	High Value Manufacturing Catapult – Skills Foresighting Process, Skills Escalator, MERINOVA Digitalisation Academy, Basque Industry 4.0 Strategy, JA3B, z.l.ö. - zukunft.lehre.österreich
KA 7-3	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	3. Consolidate an active automotive community focused on skills with relevant participation of stakeholders, with particular reference to companies, national associations and VET providers	High Value Manufacturing Catapult – Skills Foresighting Process, Skills Escalator, MERINOVA Digitalisation Academy, Basque Industry 4.0 Strategy, JA3B, z.l.ö. - zukunft.lehre.österreich

CODE	MAIN TOPIC	SPECIFIC ACTIVITIES	GOOD PRACTICE
KA 7-4	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	4. Facilitate access to and involvement in the automotive skills community through direct active engagement and communication	WMCA Levy Transfer, Car Mechatronic Learning Path, High Value Manufacturing Catapult – Skills Foresighting Process, Skills Escalator, Automotive Technology - Level 5, AVL System Engineering Labour, MERINOVA Digitalisation Academy, Basque Industry 4.0 Strategy, TU Graz Life Long Learning, JA3B, z.l.ö. - zukunft.lehre.österreich, Girls Day, Dual Training
KA 8-7	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	7. Create links between automotive businesses and VET providers for a widespread sharing of results of intelligence update outcomes	Car Mechatronic Learning Path, Automotive Technology - Level 5, AVL System Engineering Labour, MERINOVA Digitalisation Academy, TU Graz Life Long Learning
KA 8-8	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	8. Build a common dialogue platform to inform companies and VET providers about the different needs and create a common vision for the future	Dual Certification, Cedefop European Database on Apprenticeship Schemes
KA 7-6	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	6. Organise events aimed at facilitating exchange between key stakeholders	DRIVES webinars, z.l.ö. - zukunft.lehre.österreich
KA 8-6	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	6. Act as a platform for Automotive Skills Agenda and stimulate its continuous development	Basque Industry 4.0 Strategy
KA 7-5	FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS	5. Keep sectoral intelligence constantly updated by involving in sharing of information the largest possible base of members of the automotive community in sharing of information focused on skills	High Value Manufacturing Catapult – Skills Foresighting Process
KA 1-3.1	INTELLIGENCE	3.1. Collecting and monitoring of EU Automotive vacancies in order to detect recruitment patterns and changing skill needs.	WP6.1 - Jobs vacancy & skills dashboard
KA 2-1	INTELLIGENCE	1. EU-wide database of education providers (focused on universities, VET providers and apprenticeships) to be established	WP5.4 - Apprenticeship Comparison Tool
KA 5-1	INTELLIGENCE	1. Identify specific needs for workers with lower levels of skills	Skills Escalator
KA 5-3	INTELLIGENCE	3. Identify specific needs for workers with high levels of skills	Skills Escalator, Degree Apprenticeships
KA 2-2.4	INTELLIGENCE	2.4. Establish methods for comparing the mix of training (including apprenticeships) offered by skill area and in different nations	WP5.4 - Apprenticeship Comparison Tool
KA 3-1.1	INTELLIGENCE	1.1. Define the most effective VET approach and appropriate implementation measures for different stakeholders in the Automotive sector	High Value Manufacturing Catapult – Skills Foresighting Process, Skills Escalator, MERINOVA Digitalisation Academy, Basque Industry 4.0 Strategy, JA3B, z.l.ö. - zukunft.lehre.österreich
KA 2-3.4	INTELLIGENCE	3.4. Support and stimulate development of education and training specifically focused on identified skill gaps	Car Mechatronic Learning Path, High Value Manufacturing Catapult – Skills Foresighting Process, Skills Escalator, Automotive Technology - Level 5, AVL System Engineering Labour

CODE	MAIN TOPIC	SPECIFIC ACTIVITIES	GOOD PRACTICE
KA 7-1	INTELLIGENCE	1. Optimise tools for data gathering and elaboration	WP6.1 - Jobs vacancy & skills dashboard, Cedefop European Database on Apprenticeship Schemes
KA 7-2	INTELLIGENCE	2. Provide easily accessible data reflecting the current situation of the sector	WP6.1 - Jobs vacancy & skills dashboard, Cedefop European Database on Apprenticeship Schemes
KA 7-8.1	INTELLIGENCE	8.1. Present trends and future foresight to education and training providers for a better vision of future needs and possible changes	DRIVES webinars, z.l.ö. - zukunft.lehre.österreich
KA 7-7.4	INTELLIGENCE	7.4. Identify automotive job roles linked to the identified changes in the sector	Car Mechatronic Learning Path, Automotive Technology - Level 5
KA 8-2	INTELLIGENCE	2. Harmonise a set of areas and base objectives and specific objectives that will reflect all elements of skills agenda	High Value Manufacturing Catapult – Skills Foresighting Process, Skills Escalator, MERINOVA Digitalisation Academy, Basque Industry 4.0 Strategy, JA3B, z.l.ö. - zukunft.lehre.österreich
KA 1-3.3	INTELLIGENCE	2.2. Update existing curricula to address the challenges and skills changes	High Value Manufacturing Catapult – Skills Foresighting Process, Degree Apprenticeships, MERINOVA Digitalisation Academy
KA 2-3.2	TRAINING PROGRAMMES	2.1. Set up training programmes with train- the-trainers approach focused to technical skills, digital skills and soft skills	MERINOVA Digitalisation Academy, STEM Talent Girl Program, TU Graz Life Long Learning
KA 5-2	TRAINING PROGRAMMES	3.2. Ensure concerted effort to train-the- trainers, in order to expand the numbers of VET and training organisations able to provide skills according to the priorities defined by the sector	TU Graz Life Long Learning
KA 5-4	TRAINING PROGRAMMES	2. Develop specific training activities/programmes for workers with lower level of skills to upgrade their skills and create clear progression pathways between different training levels	Skills Escalator, Dual Certification, Soldematic, Azubi Car – Skoda Auto
KA 2-2.2	TRAINING PROGRAMMES	4. Develop specific training activities/programmes for workers with high level of skills, to upgrade their skills and ensure clear progression pathways between different training levels	Skills Escalator, Dual Certification, Automotive Technology - Level 5, Degree Apprenticeships, E-learning Apprenticeship Delivery, Soldematic, Azubi Car – Skoda Auto
KA 6-1.3	TRAINING PROGRAMMES	3.5. Prioritise the adoption and development of the "training on the job" process with a harmonisation of national rules to permit an easy and quick procedure and facilitating the movement of students between countries	Skills Escalator, Dual Certification, Automotive Technology - Level 5, Degree Apprenticeships, E-learning Apprenticeship Delivery, Soldematic, Azubi Car – Skoda Auto
KA 2-2.3	TRAINING PROGRAMMES	1. Stimulate preparation of new modular training and education plans and curriculum	E-learning Apprenticeship Delivery, TU Graz Life Long Learning, Dual Training

Few Specific Activities of the DRIVES RoadMap have not been mapped according to related Key Actions created for "project sustainability" purpose and not valuable for Automotive Stakeholders engaged in regional workshops.

A.2 INPUT FROM THE AUTOMOTIVE SKILLS ALLIANCE PARTNERSHIP

Automotive Skills Alliance (ASA) partnership helped to better frame the 4 topics through validation and integration during dedicated meetings[33]. Results are presented below.

1. STANDARD DEFINITION

Within the topic of standard definition, participants were asked if they found difficulties in defining targeted skills when building a project in their region geared at the training of individuals. According to Figure 9, 73% of participants perceive it as a difficulty.

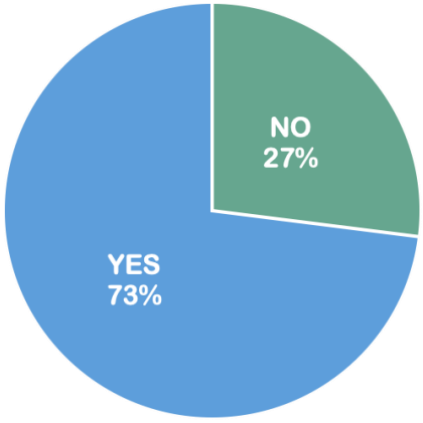

Figure 9: Standard definition - ASA feedback

In addition, participants were also asked which resources they tend to use to tackle the above challenge. As evidenced in Figure 10, most of them rely on “existing reference framework by the key stakeholders, including large, medium and small industry”.

[33] *Meeting was held on May 12, 2021*

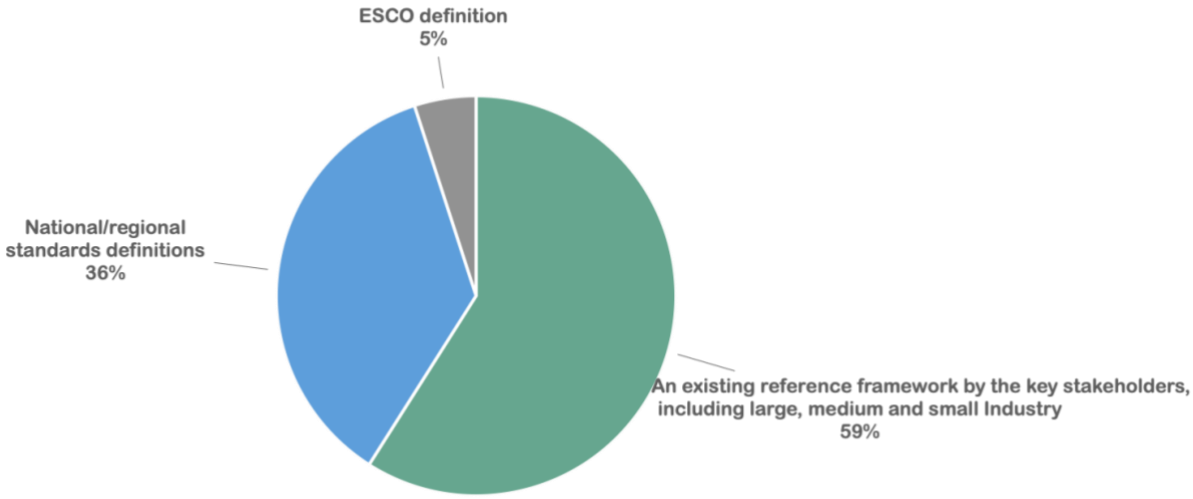

Figure 10: Standard definition, resources used- ASA feedback

2. FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS

Similarly, with reference to the topic of facilitating encounters between different stakeholders, participants were asked if they found difficulties in getting in touch with relevant stakeholders when building a project in their region geared at the training of individuals. Most of them (80% - Figure 11) do not perceive it as a difficulty.

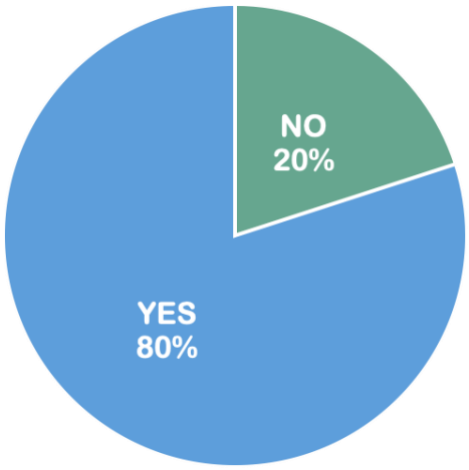

Figure 11: Facilitating encounters between different stakeholders - ASA feedback

3. INTELLIGENCE

Regarding intelligence, participants were asked if they found difficulties in identifying key drivers of change in their region when building a project geared at the training of individuals. Responses on this topic were balanced, as shown in Figure 12.

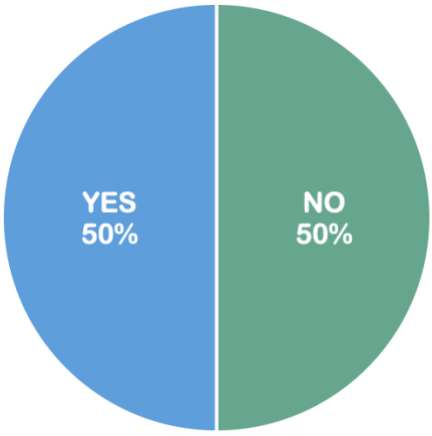

Figure 12: Intelligence, difficulties in identifying key drivers of change - ASA feedback

The following question was dedicated to investigating the means used to improve intelligence. According to Figure 13, "consultation with automotive companies/clusters" (26%) seems to be the most commonly used practice.

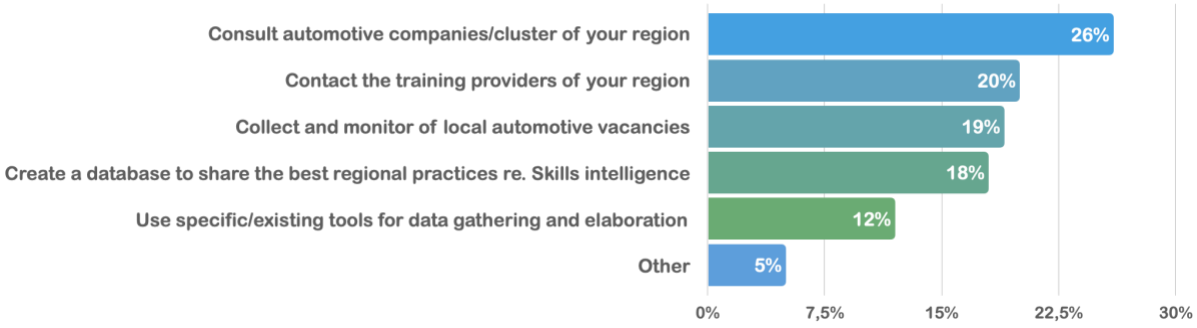

Figure 13: Intelligence, suggested improvement - ASA feedback

Finally, participants were asked what skills intelligence gathering technique they would like to have access to going forward. "Results of questionnaires from relevant stakeholders" (28%), followed by "direct interviews with industry" (27%) were the most voted options (Figure 14).

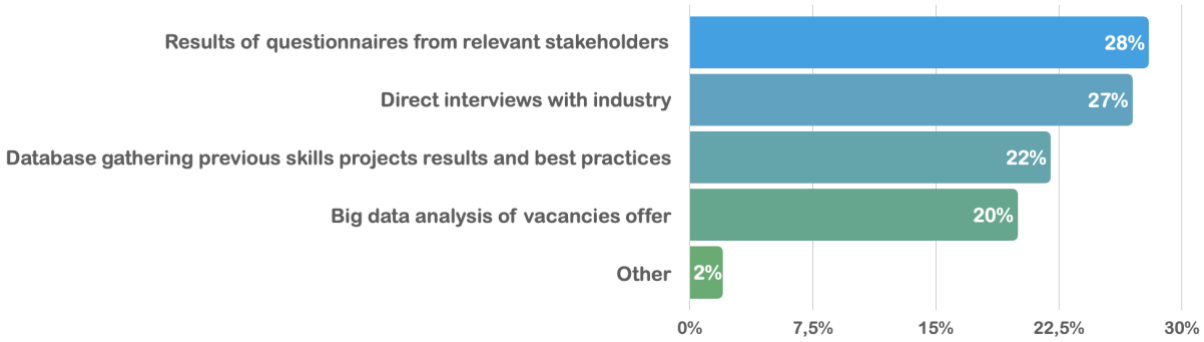

Figure 14: Intelligence, suggested gathering technique - ASA feedback

4. TRAINING PROGRAMMES

On the topic of training programmes, participants were asked if they found difficulties in developing and promote sectoral training when building a project geared at the training of individuals. As shown in Figure 15, most of them (79%) perceive it as a difficulty.

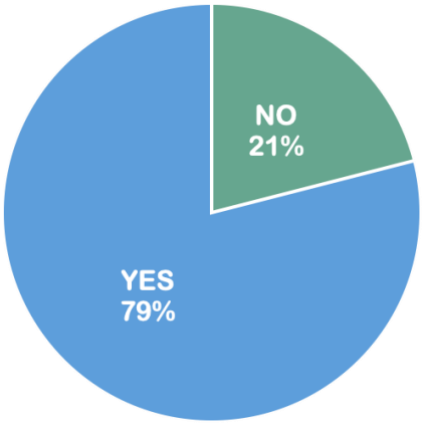

Figure 15: Training programmes - ASA feedback

According to Figure 16, which investigates which target groups are prioritized by participants, the most voted response is “workers for the automotive eco-system” (34%), followed by “students” (28%).

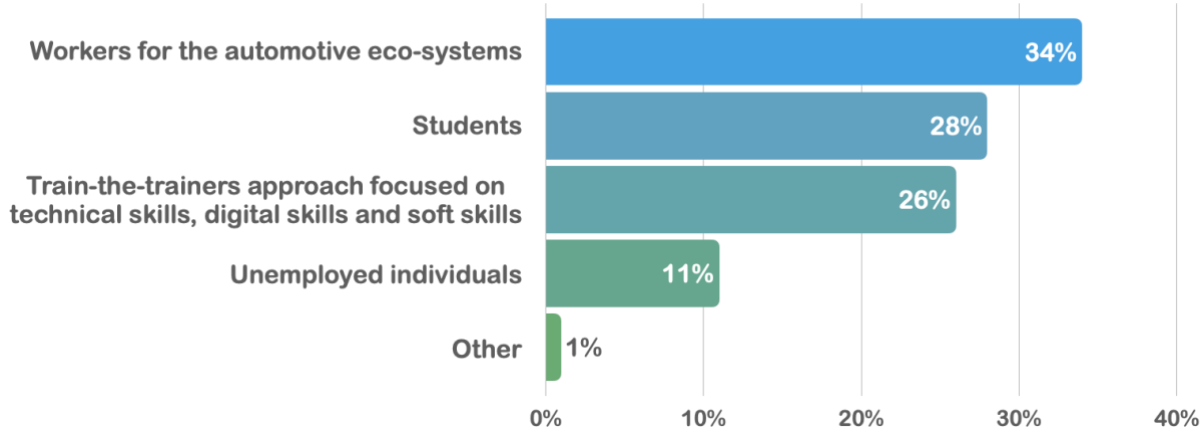

Figure 16: Training programmes, prioritized target group - ASA feedback

Participants were then asked which training options would be the most attractive for their region. In Figure 17, we can evidence that "Prioritise the adoption and development of the "training on the job" process and stimulate a regulatory framework to allow for these skills' transferability across the EU" was the most voted one (35%), followed by "Stimulate preparation of new modular training and education plans and curriculum" (34%).

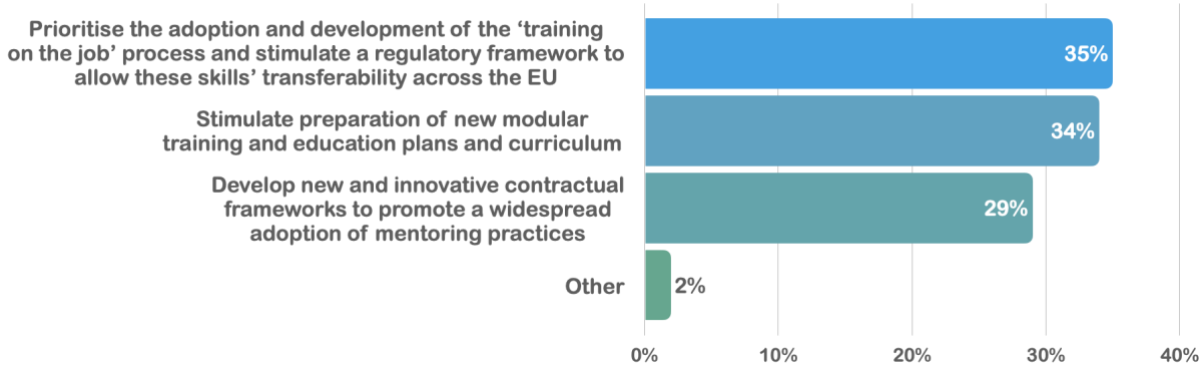

Figure 17: Training programmes, most attractive training options - ASA feedback

As a final question, participants were asked which supportive actions would be most appropriate to reach out to their target group. "Inform the target groups of the evolution of the sector towards digital and environmental objectives" was the most voted response (31% - Figure 18).

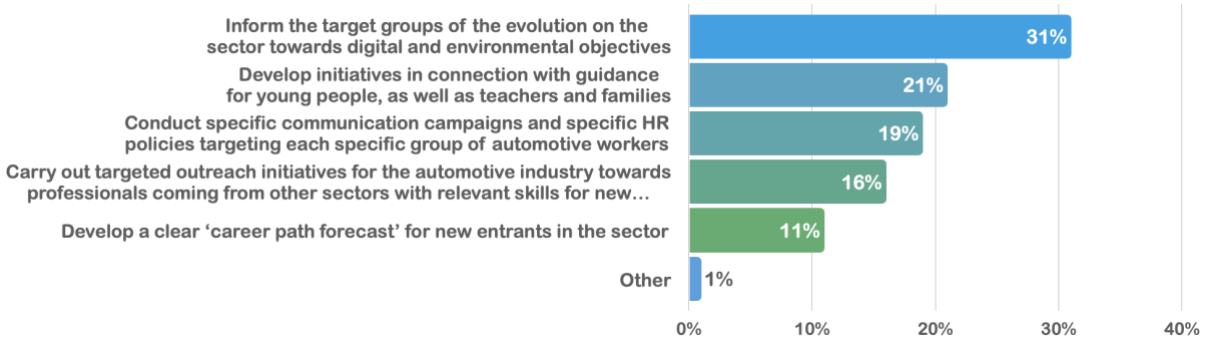

Figure 18: Training programmes, appropriate supportive actions - ASA feedback

APPENDIX B – DETAILED WORKSHOPS RESULTS

B.1 OUTCOMES PRESENTED DURING WORKSHOPS (FROM FIRST AND SECOND RELEASE)

The following results (based on the work done as part of the first and second release) were presented at the beginning of each workshop with automotive regional stakeholders in order to prepare the ground for a positive interaction.

As part of the first release of the roadmap, DRIVES launched two online questionnaires (so called "Demand" and "Offer" questionnaires) during these two years supporting the creation of this strategic roadmap for the sector. This activity and the related data elaboration were essential to understand the current vision of the sector by the stakeholders (industry and service providers).

The "Demand" survey was left relatively open ended in order to gather as much information as possible to support understanding and analysis of the sector's skills agenda and needs. A harmonisation process was therefore necessary to prepare a structured map to properly aggregate information and accurately reflect stakeholder responses. The questionnaire was designed for two different categories of stakeholders: Companies and Organisations, with differences in the wording of the questions to reflect these two different categories of respondent. The "Offer" survey was a multichoice questionnaire, based on the outcomes normalised replies of the "Demand" one. The stakeholders targeted for the surveys are outlined in Figure 19.

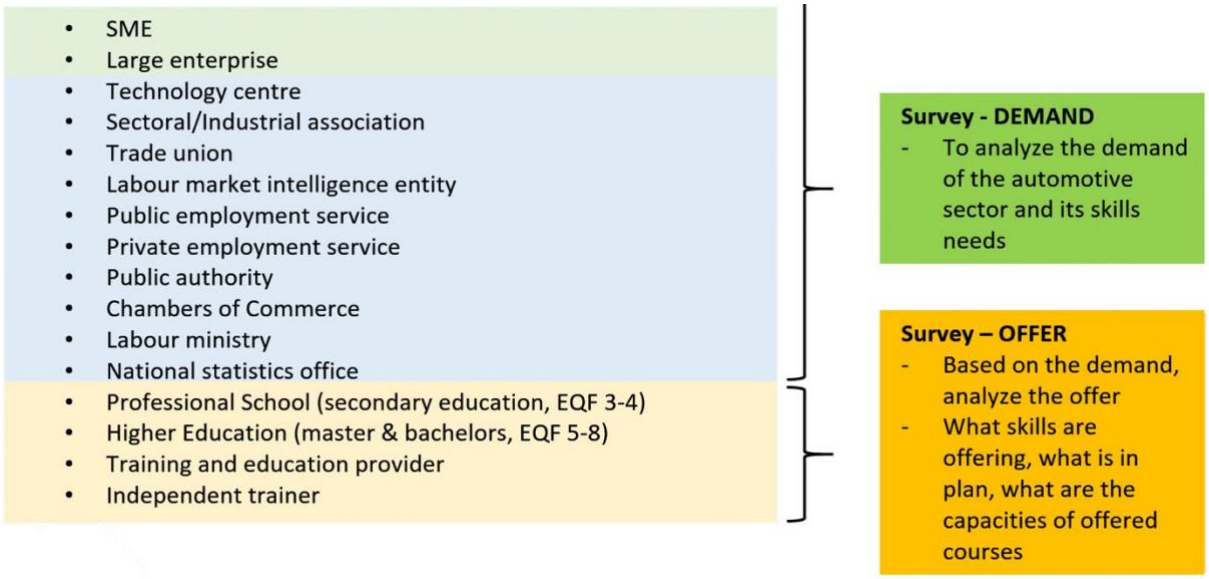

Figure 19 List of stakeholders engaged in the Work Package 2 questionnaires

Even if the stakeholders in both surveys are different, WP2 tried to address the questionnaires to decision-maker such as Directors, CEO and Managers. Into the Offer survey we also involved professors and Trainers, as they are considered the "material performers" of the training activity.

B.1.1 DRIVERS OF CHANGE

Five main macro groups of Drivers of Change were identified:

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

A detailed description of difference between Demand and Offer for each Driver of Change has been outlined into the Deliverable D2.8.2 "GAPS ANALYSIS"[34]

The current sectoral view is presented with a comparison of the five macro-Groups of Drivers of Change with reference to the IMPORTANCE and URGENCY, using also the PRIORITY INDEX[35]

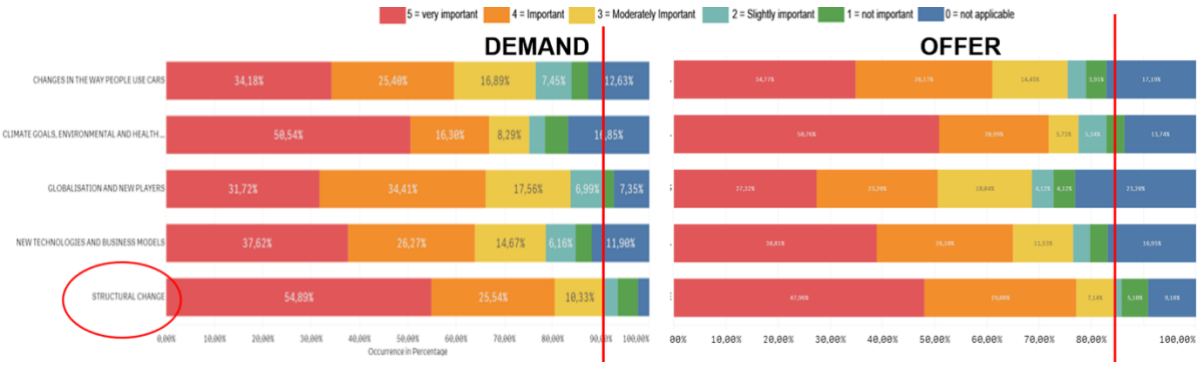

Figure 20 DoC IMPORTANCE comparison between the 2 surveys

[34] *DRIVES, https://www.project-drives.eu/Media/Publications/208/Publications_208_20210207_20596.pdf, November 2021*

[35] *The DoC PRIORITY INDEX is stated as: Priority (1 to 5) x Timeframe (2020=5, 2025=3, 2030 and further=1). More details are available into DRIVES Deliverable D2.8*

The relative importance attached to different Drivers of Change by respondents to both surveys (Demand & Offer) were quite similar in many respects in Figure 20. However, "STRUCTURAL CHANGES" (55% citing this as very important, with "ACQUISITION OF NEW SKILLS" and "CONTINUOUS TRAINING" as most important drivers) was ranked first in the Demand survey based on the overall sample, while with respect to overall responses to the Offer survey "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES" (51%) was ranked first on this basis. Comparison of the two sets of responses with respect to "STRUCTURAL CHANGE" (restructuring, acquisition of new skills, continuous training) points to a difference of 7% between overall demand and offer survey responses identified as very important.

Figure 21 DoC URGENCY comparison between the 2 surveys

With regards to the urgency, even if the ranking between Demand and Offer is similar in terms of position in Figure 21, with "STRUCTURAL CHANGE" identified by both as very urgent (by 2020), the real main difference between Demand and Offer is that respondents of the Offer survey are more likely to cite a longer-term urgency (by 2025) for all specific Drivers of Change.

B.1.2 OCCUPATIONS / JOB ROLES

Due to the fact that DRIVES interact with a heterogeneity of stakeholders and most of them are not aware of the language-technicality related to ESCO classification[36], the partnership agreed to prefer a clear message instead of a technically precise information.

An occupation is a grouping of jobs involving similar tasks and which require a similar skill 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 (Occupations

[36] https://ec.europa.eu/esco/portal/escopedia/Main_Page, *March 2020*

can be used as job titles); nevertheless, for the DRIVES project Occupation is used as synonymous per Job Role as many stakeholders involved use both terminologies with the same meaning (most of the time Job Role is preferred to Occupation).

A specific question into the "Offer" questionnaire was not implemented regarding this topic (DRIVES Project preferred an approach based on "skills" instead of "jobs" for VET providers) it is still possible to analyse, as per Figure 22, the current Demand of Job Roles and open a clear discussion on this issue with stakeholders:

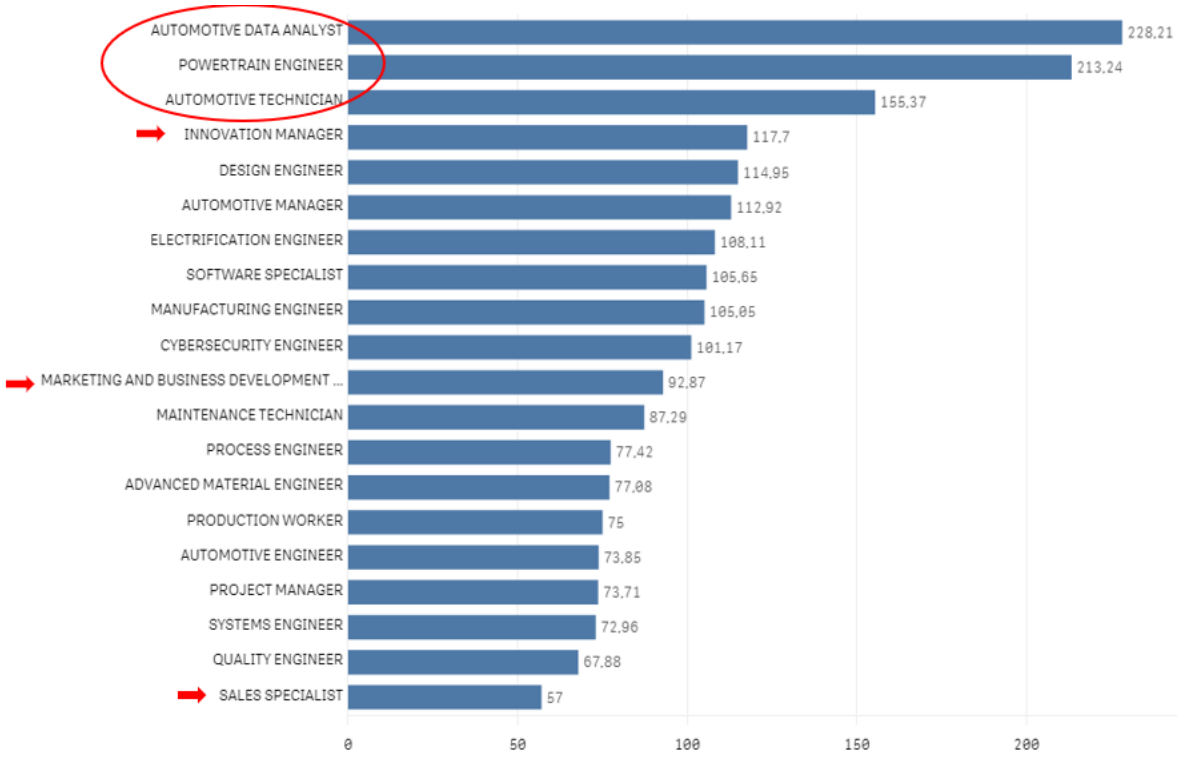

Figure 22 Job Roles INDEX (Demand survey) TOP 20 list

Figure 22 shows the top 20 JOB ROLES INDEX[37]. Based on this, the positions ranked first, second and third are all automotive specific roles, these being "AUTOMOTIVE DATA ANALYST", "POWERTRAIN ENGINEER" and "AUTOMOTIVE TECHNICIAN". The first non- Automotive specific Job Role is ranked 4th and is "INNOVATION MANAGER". Only two sales job roles are in this list at 11th and 20th as "MARKETING AND BUSINESS DEVELOPMENT MANAGER" and "SALES SPECIALIST".

[37] *The JOB ROLE INDEX is stated as: Occurrence (of each JobRole) x Priority DoC Index (average of each JobRole). More details are available into DRIVES Deliverable D2.8*

B.1.3 SKILLS

The WP2 Skills normalisation process was a challenging activity requiring several steps and iterations. Responses in relation to skills were often not identified as action verbs[38] but, more commonly, as a group of jobs, or complex activities. Through intensive discussions with those partners involved in the normalisation process, 5 main categories, or clusters of skills have been identified, according to DRIVES Deliverable 2.7: 4 of these being "technical" and the 5th related to previously identified "soft skills". Specific job roles comprise different combinations of these skills.

A detailed description of difference between Demand and Offer has been outlined into the Deliverable 2.8 "Skills need and gap".

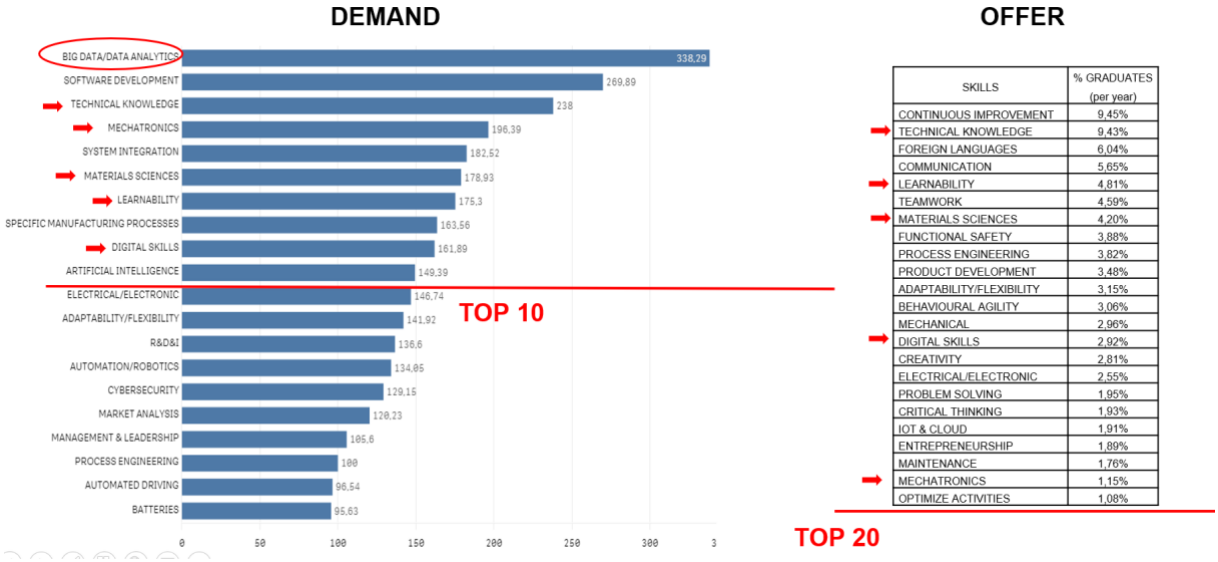

Figure 23 Skills comparison between the 2 surveys

Comparing TOP 10 Demand (of skills) with the Offer as per Figure 23, it is necessary to increase the range from TOP 10 to TOP 20 into the Offer list to find at least 5 similarities.

"TECHNICAL KNOWLEDGE" (3rd in Demand and 2nd in Offer), "MATERIAL SCIENCES" (6th in Demand and 7th in Offer) and "LEARNABILITY" (7th in Demand and 5th in Offer) are comparable. "MECHATRONICS" (4th in Demand and 19th in Offer) and "DIGITAL SKILLS" (9th in Demand and 14th in Offer) are relative

[38] *According to ESCO: a skill is the basic talent (described with action verb) necessary to categorise all the Occupations, March 2020, [https://europass.cedefop.europa.eu/documents/european-skills-passport/certificate-supplement/action-verbs-glossary]*

not aligned. More than before, now the difference between Demand and Offer is evident and it is important to better evaluate this situation.

B.1.4 MAIN CONSIDERATIONS AND GAPS

The previous analysis illustrates and confirms that STRUCTURAL CHANGES Group (composed by the two Drivers of Change "continuous training" and "acquisition of new skills") is considered as "very urgent" from the "Demand", whereas they are "urgent" from the "Offer" side. Job Roles and Skills needs to be better evaluated between "Demand" and "Offer".

The exchange of information between the main groups of stakeholders should be improved to better understand the real need of urgency; moreover the "Offer" stakeholders should modify educational processes and content according to the needs of the "Demand" side with a continuous and planned exchange of information.

It is important to provide a definition of skills and job roles relevant for automotive-mobility ecosystem with an online database of available training courses.

A detailed gap analysis is available at D2.8.2 "GAPS ANALYSIS"[39]

B.2 SELECTED BEST PRACTICES

Below are listed the best practices presented to automotive regional stakeholders through the dedicated workshops held online in Germany, Italy, Poland, Portugal, Romania and Spain. For each of the 4 main topics, 2 best practices were chosen as *best examples* to be presented.

1. STANDARD DEFINITION

BP1.1: CEDEFOP EUROPEAN DATABASE ON APPRENTICESHIP SCHEMES

Brief description: apprenticeship information resource developed by CEDEFOP. This database enables different EU countries apprenticeships to be compared. As a result of the range of information collected and its broad focus the comparisons can be made on a country level or a scheme level.

[39] *DRIVES, https://www.project-drives.eu/Media/Publications/208/Publications_208_20210207_20596.pdf, November 2021*

Benefits:

- Country fiches: navigation and understanding of apprenticeships from a national context.
- Scheme fiches: this focuses on specific country schemes identifying their features. As some countries have more than one scheme it separates them so that individual schemes and their characteristics can be examined
- Comparison tables: comparison of countries and schemes. It can help identify countries with similar schemes and characteristics
- Map: visual representation of the number of apprenticeship schemes within a country
- Advanced search: this feature provides indicators which can be selected based on interest

BP1.2: GERMAN/SPANISH DUAL CERTIFICATE

Brief description: The German Chamber of Commerce in Spain worked in partnership with Volkswagen to create the first German/Spanish dual certificate. The programme was developed by a group of experts who analysed the competences covered in both countries as a basis for the development of a three-year curriculum for Volkswagen incorporating best practices from both countries. Programmes were developed covering five different job roles. SEAT brand is also now fully involved in the Dual Certification programme.

Benefits:

- Each student completing the exam is awarded both the German and Spanish certificate
- It increases talent development locally and supports the development, presence, and strength of participating German companies internationally
- It creates good vocational opportunities and opens alternative pathways for students

Challenges:

- Engage with the relevant local authorities
- Ensure the quality of the programme by making sure personnel across the whole company understand what Dual Training comprises and tutors are properly informed/trained

2. FACILITATING ENCOUNTERS BETWEEN DIFFERENT STAKEHOLDERS

BP2.1: Z.L.Ö. - ZUKUNFT.LEHRE.ÖSTERREICH – AUSTRIA

Brief description: To strengthen the image of apprenticeship, z.l.ö. - zukunft.lehre.österreich., which is an independent, non-profit and cross-sector initiative (largest apprenticeship initiative in Austria with more than 130 member companies) aims at highlight the advantages, possibilities and opportunities of an apprenticeship and permanently improving the reputation of dual training in Austria. This is achieved through a wide range of promotional, networking and other activities.

Benefits:

- Additional value for its member companies: collaborative initiatives with skilled professional providers
- Tackle skill shortages
- Identify demands from different stakeholders

Challenges:

- Effective marketing campaign and finding positive testimonials for the future generation
- Synergies among the different stakeholders

BP2.2: JUNIOR AUTOMOTIVE APPRENTICESHIP ADVISORY BOARD (JA3B)

Brief description: an initiative led by Gestamp - multinational company involved in the global automotive industry, in collaboration with the Universidad de Mondragon and sponsors in Spain. JA3B is an event hosting young people from 14 to 18years-olds from different European countries, organized to design and think collaboratively about the future of the automotive industry, not only in the professional field but also in academia. Its aims include discussing participants experiences of the automotive sector, its future challenges and the development of a strategic action plan to make it an exceptional place to work.

Benefits:

- Companies get first hand impressions from European youth regarding the attractiveness of employment in the automotive sector
- Nurture a sense of European citizenship through sharing common practices and challenges

Challenges:

- Finding sponsors to finance student's travel and accommodation expenses to the event
- Strong time investment from organizers

3. INTELLIGENCE

BP3.1: HIGH VALUE MANUFACTURING CATAPULT – SKILLS FORESIGHTING PROCESS

Brief description:

The future skills foresighting process in the UK is an example of a structured process of engaging with research organisations and employers to understand new organisational capabilities needed in the automotive sector in 3 to 5 years' time and then engaging with employers and educators to identify the competencies (knowledge and skills) needed to implement the capabilities. The Foresighting process consists of engaging with these 3 sets of stakeholders with each stage creating an output used in the next stage. Research organisations are by definition looking at future challenges and capabilities; employers know how these capabilities will be developed and which job types will be impacted and, of course, educators are experts in turning the capabilities into competency statements and, ultimately, training courses.

Benefits:

- Good engagement with all stakeholders
- Competency statements that have been honed to ensure the content is focussed on future needs
- Identifying organisational capabilities as the foundation for the new competencies.
- Taking a structured approach which means each stakeholder adds value to the process.

Challenges:

- Process development

- Factoring in existing resources (such as existing qualifications content and the National Occupational Standards and the communication of the results of the Foresighting process where it's proven to be difficult to report outputs in a simple form.

BP3.2: SKILLS ESCALATOR

Brief description:

The MIRA Technology Institute (MTI) - facility based in the West Midlands Region in the UK, is helping to create specialist skills in some of the new emerging technology areas within the automotive sector, including electrification and driverless cars, with the goal of ensuring a sustainable supply of future technical specialists and engineers. The MTI offers flexible delivery designed to meet the needs of individuals and businesses. Training courses offered cover Automotive Engineering; Business and Leadership; Connected and Autonomous Vehicles; Electric and Hybrid Vehicles and Vehicle Safety and Security and Cyber Security.

Benefits:

- Enables students to progress through different levels and move seamlessly between training partners within MTI rather than having to seek training outside of the initiative
- Accessing automotive training whether they are starting at ground level or need higher level qualifications
- Highly attractive for learners
- Beneficial for employers to be able to access all the skills training that they need from a single organisation

Challenges:

- Ensuring effective collaboration between industry and education
- Matching the pace and agility of industry with the longer lead times in curriculum development in the education sector

4. TRAINING PROGRAMMES

BP4.1: TU GRAZ LIFE LONG LEARNING

Brief description:

TU Graz University in Austria supports companies in bringing their staff up to date with the latest developments in science, commerce and technology. Furthermore, companies can talk to lecturers and adapt the courses to their individual needs. Together with selected partners, TU Graz offers a continuing education programme with several types of courses. The courses are designed for university and college graduates, experts from industry and TU Graz students. Upon completing these courses, trainees receive either a certificate of attendance, confirming that they have taken the course, or a TU Graz certificate, if the course ends with an examination.

Benefits:

- Employees are constantly trained in the latest technology or can learn completely new engineering skills without having to create in-house training facilities
- Training is up-to-date and relevant for industry needs
- Integrating scientists into the programme in order they can present the latest research findings

Challenges:

Training employees on the latest state-of-the-art technology. In some SMEs expert training on very specific topics is difficult or costly to install. The TU Graz LifeLongLearning (TUG LLL) programme supports companies that do not have a corresponding in-house training programme to be able to convey new approaches and technologies quickly and in a resource-optimised manner.

BP4.2: AZUBI CAR – SKODA AUTO

Brief description:

The Azubi Car initiative is an example of a programme at the Skoda Vocational School in the Czech Republic that gives learners the opportunity to design and manufacture their own concept car (students build their dream car). Skoda hires all the students who successfully complete the programme. Learners work under the supervision of 7 vocational teachers for support and also to ensure safety. Parts are supplied by Skoda auto, with minor exceptions (e.g., car seats).

Development and Research on Innovative Vocational Skills -DRIVES – Project number 591988-EPP-1-2017-1-CZ-EPPKA2-SSA-B
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Benefits:

- Opportunity to undertake unique complex work
- Think differently, communicate, organize, solve problems, work in teams and gain personal experience on what they have learned in a real-life situation and apply the knowledge gained
- Meet designers directly
- Possibility of future career within Skoda

Challenges:

- Logistics behind getting the parts from the Skoda auto
- Time constraints, not only in relation to production, but also in the planning phase and in relation to designing a concept.

B.3 RESULTS FOR EACH REGION

Below are presented the results from each regional workshop (Italy, Poland, Portugal, Romania and Spain[40]). As stated in the report, WP2 asked participants the following main question[41]:

"*Are similar best practices – like the ones we showed to you:*

- *Already successfully in place in your region?*
- *Not implemented in your region but potentially interesting?*
- *Not relevant for your region? And if so, are there other themes that shall be addressed that we have not covered?"*

ITALY

By taking into consideration the case of Italy, we can evidence that there is a current lack of similar practices that are implemented across the four topics. This proves to be particularly relevant for standard definition (100% - Figure 24), whereas 22% of respondents stated that there are currently practices implemented for the topic of training programmes (Figure 27).

[40] *The workshop in Germany was attended by a restrictive number of participants, therefore WP2 did not use an instant poll platform to extract results in the form of graphics, but rather topics were discussed openly during the workshop. Results are presented in chapter 5.2*
[41] *Questions were asked through an instant poll platform: www.mentimeter.com*

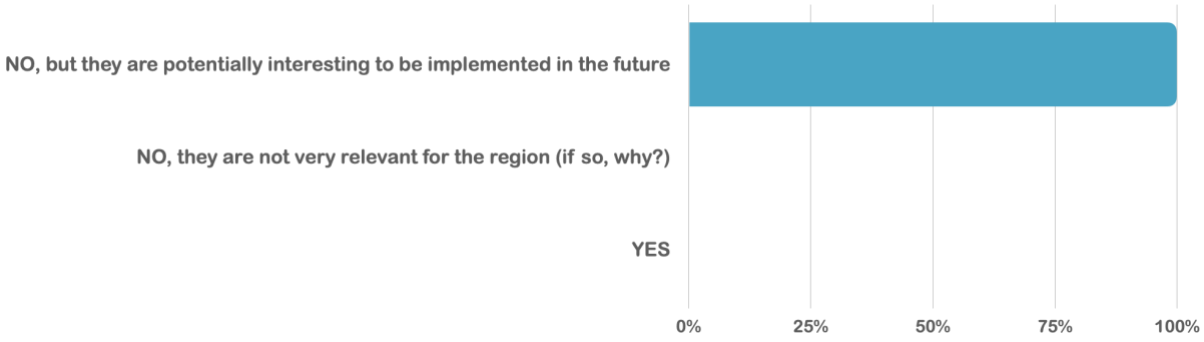

Figure 24: Standard Definition – Italy

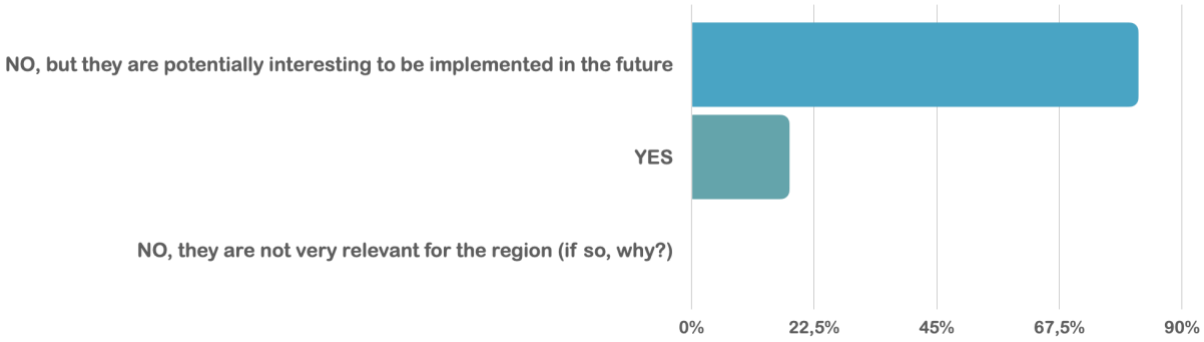

Figure 25: Facilitating encounters between different stakeholders - Italy

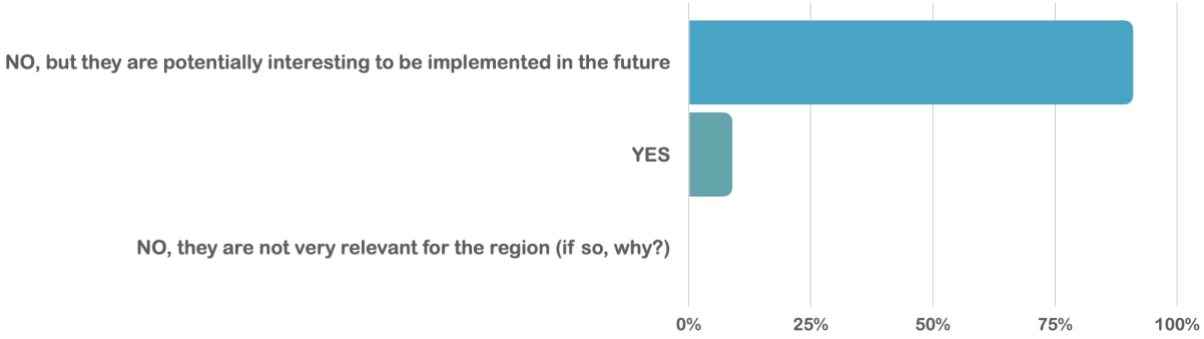

Figure 26: Intelligence - Italy

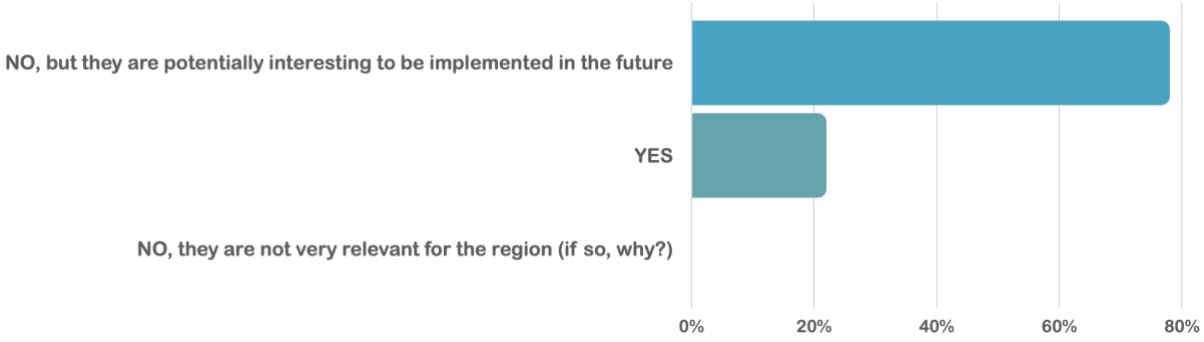

Figure 27: Training programmes - Italy

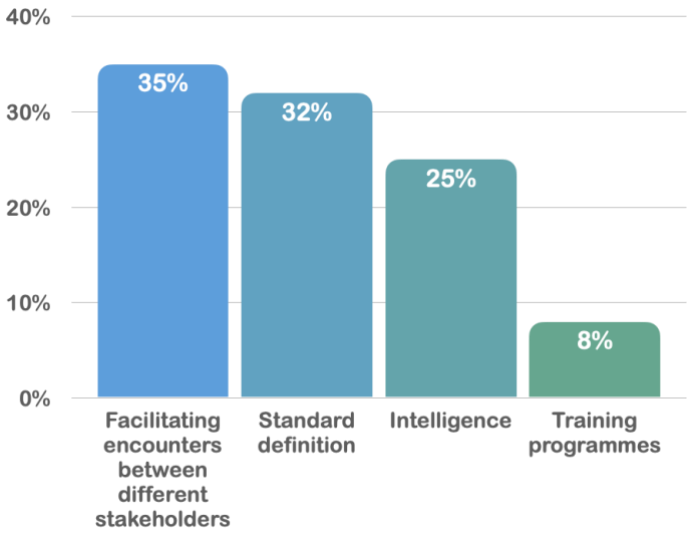

Figure 28: Most important and relevant topics as voted by participants of the Italian workshops

POLAND

With reference to Poland, responses are quite similar: 80% for "standard definition" (Figure 29) and 83% for "facilitating encounters" and "intelligence" (Figure 30, Figure 31) confirmed that they do not have similar practices that are implemented across the four topics. This is less relevant for the topic of "training programmes", where 33% state that they have practices ongoing (Figure 32).

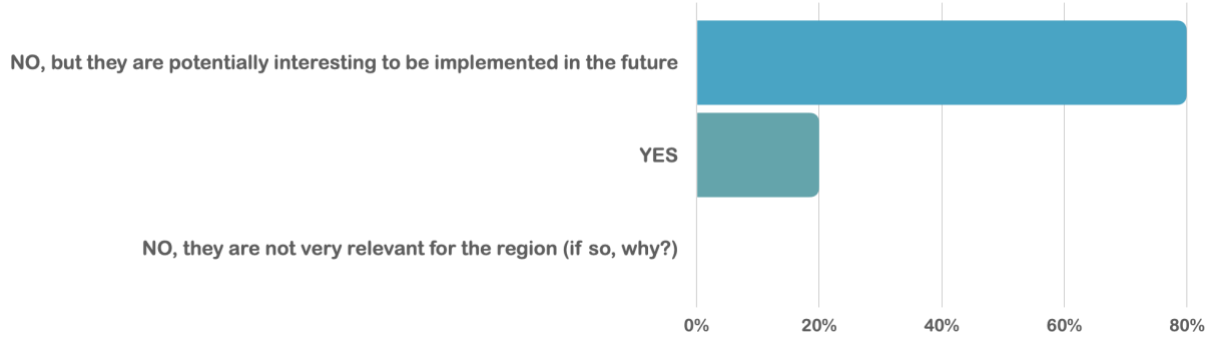

Figure 29: Standard Definition – Poland

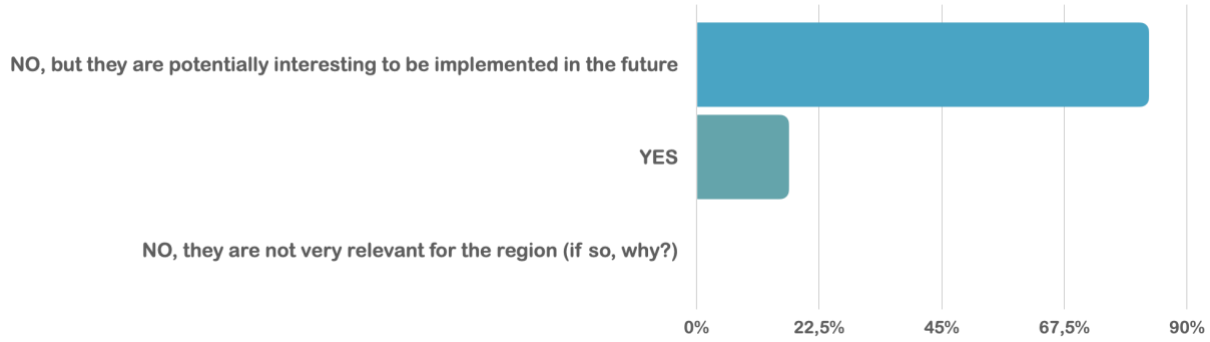

Figure 30: Facilitating encounters between different stakeholders - Poland

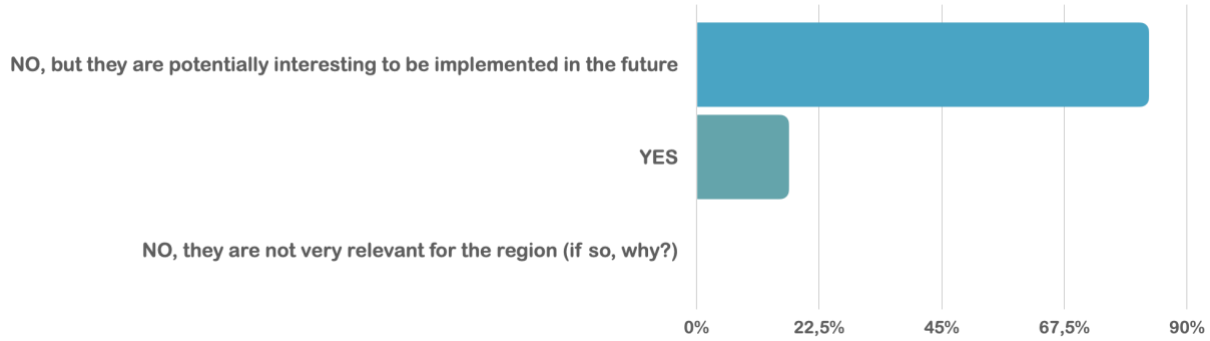

Figure 31: Intelligence – Poland

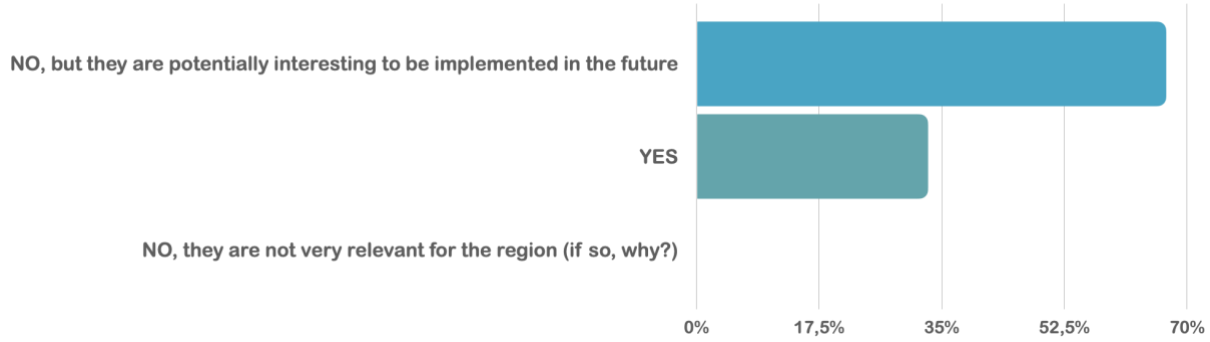

Figure 32: Training Programmes – Poland

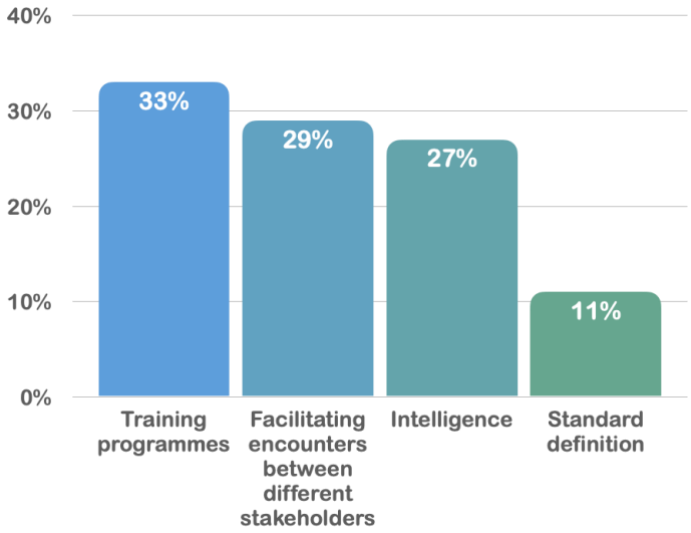

Figure 33: Most important and relevant topics as voted by participants of the Polish workshops

PORTUGAL

When looking at the case of Portugal, we can evidence that respondents do not have similar practices widely implemented across the four topics (with the exception of standard definition - Figure 34, and training programmes - Figure 37, even if only 15% and 9% respectively stated that there are current available practices).

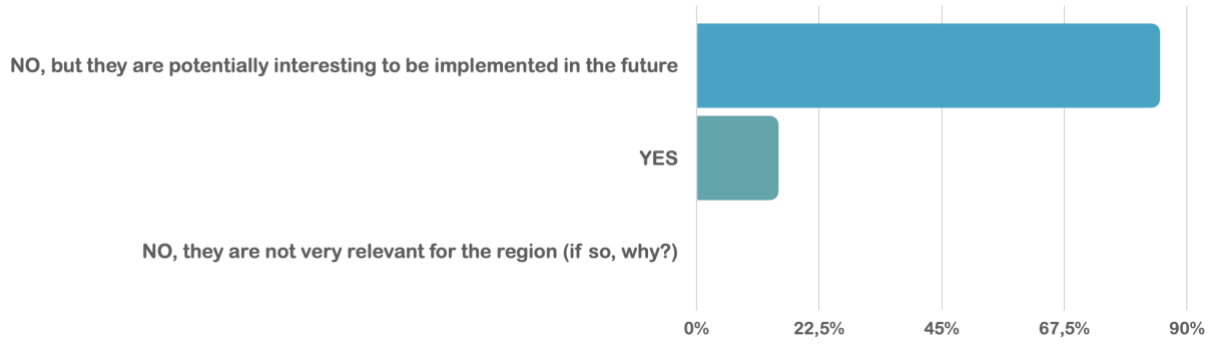

Figure 34: Standard Definition – Portugal

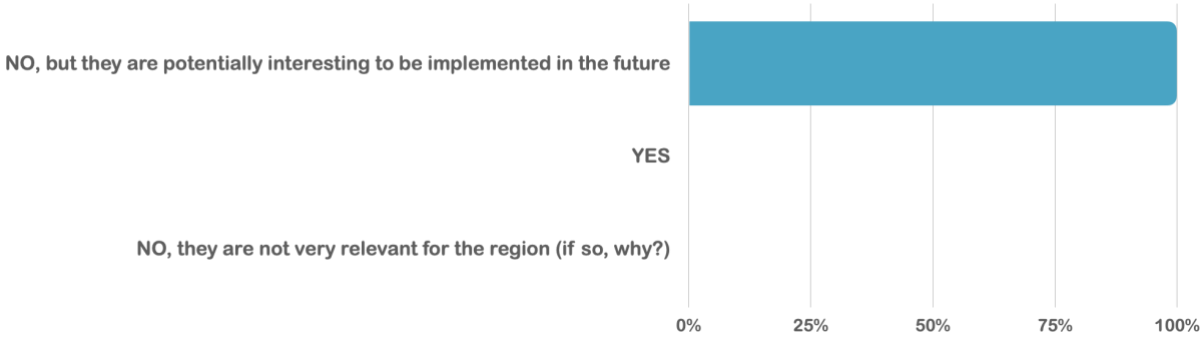

Figure 35: Facilitating encounters between different stakeholders - Portugal

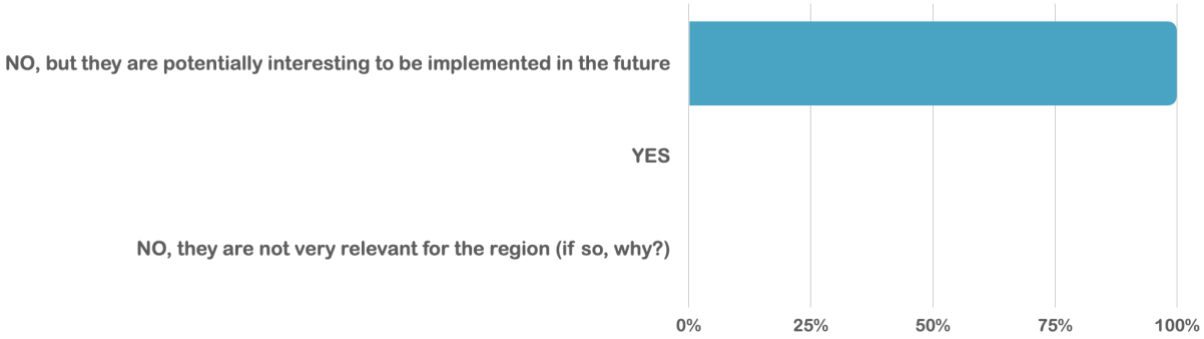

Figure 36: Intelligence – Portugal

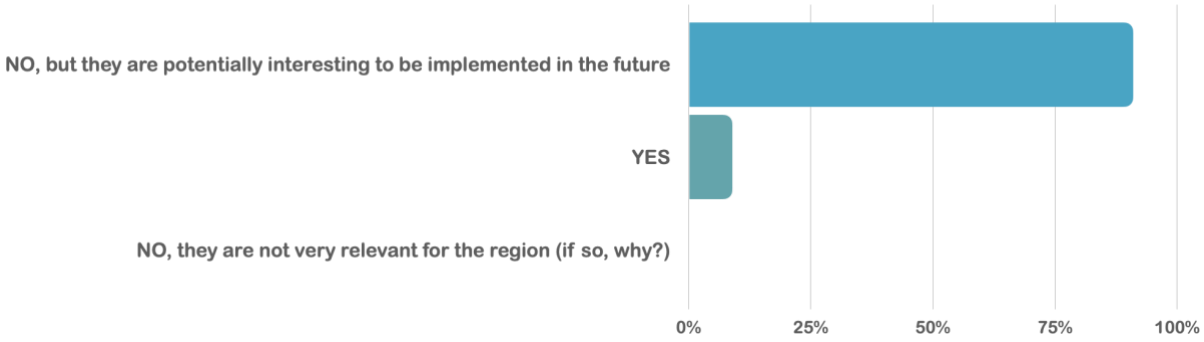

Figure 37: Training Programmes – Portugal

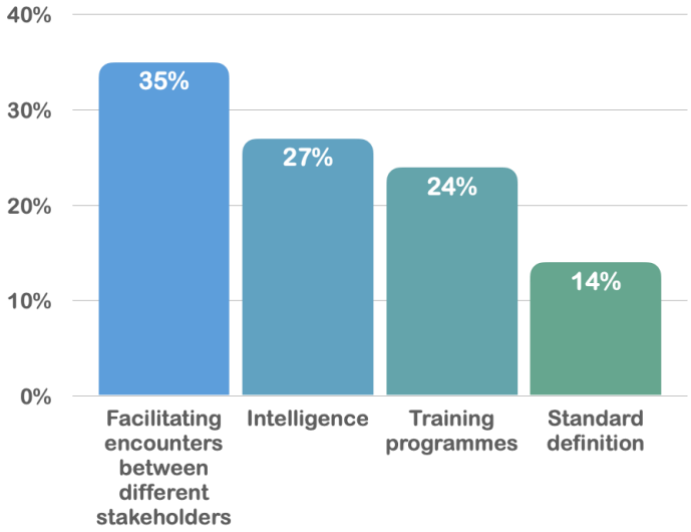

Figure 38: Most important and relevant topics as voted by participants of the Portuguese workshops

ROMANIA

As for Romania, the case is different. According to Figure 39, Figure 40, Figure 41 the gap between the "YES" and the "NO" is shorter, demonstrating that there are currently practices implemented on "standard definition", "facilitating encounters" and "intelligence". As for "training programmes" (Figure 42), it is possible to evidence that there are consolidated practices ongoing (64% of respondents replied "YES"), therefore Romania seems to be more advanced on the development of trainings and relevant good practices.

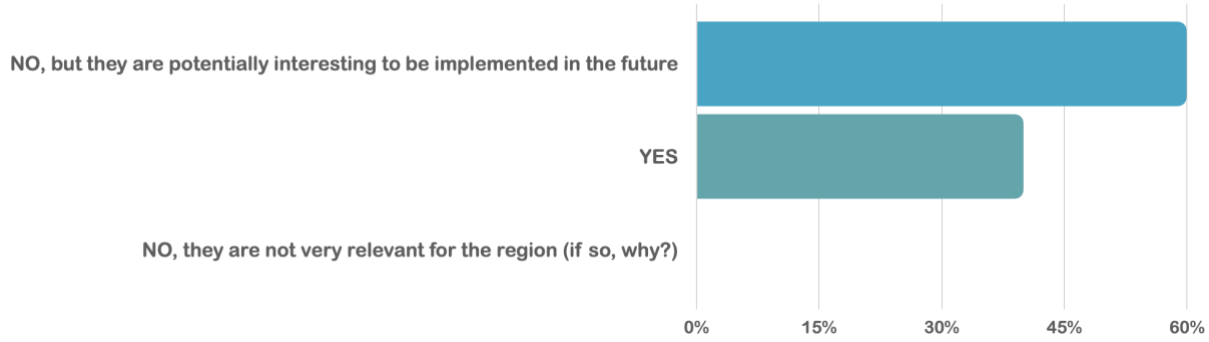

Figure 39: Standard Definition – Romania

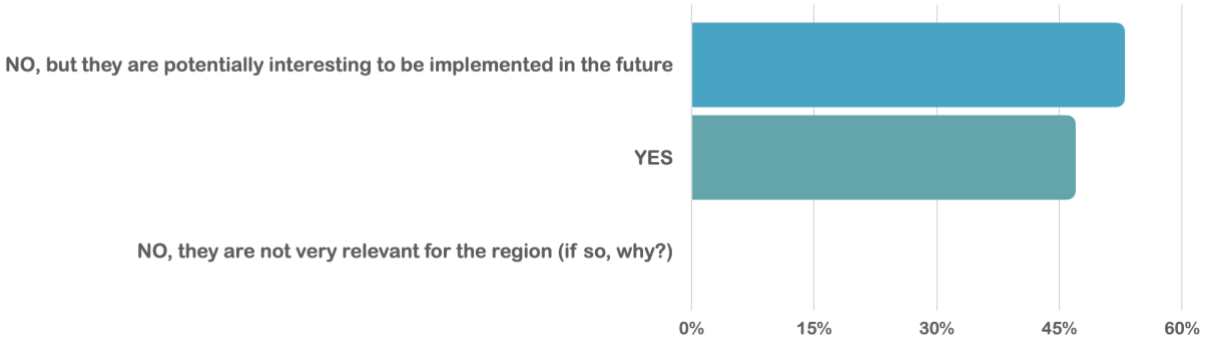

Figure 40: Facilitating encounters between different stakeholders – Romania

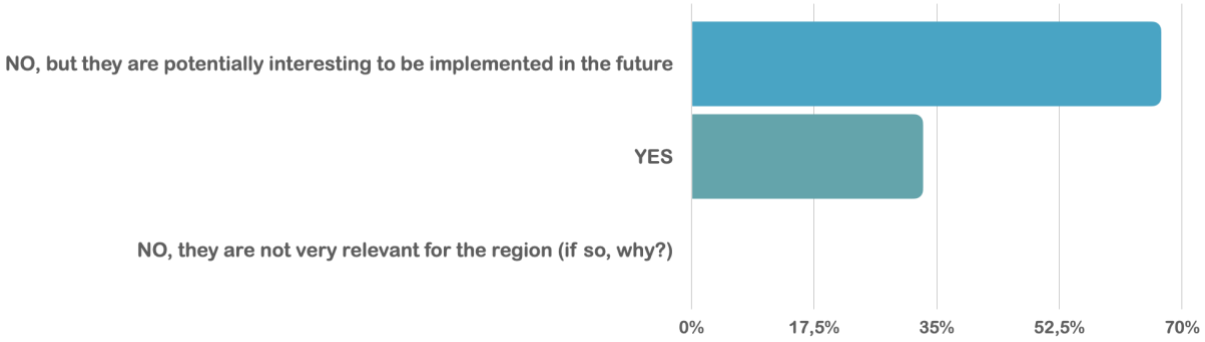

Figure 41: Intelligence – Romania

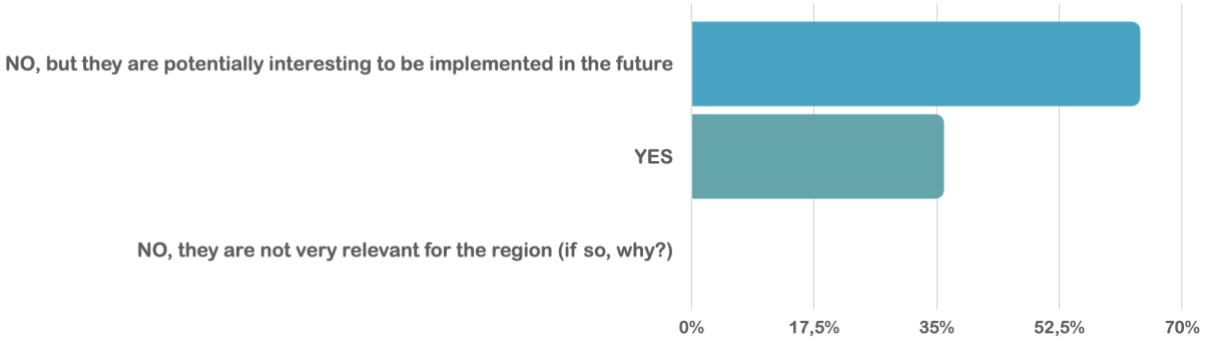

Figure 42: Training Programmes – Romania

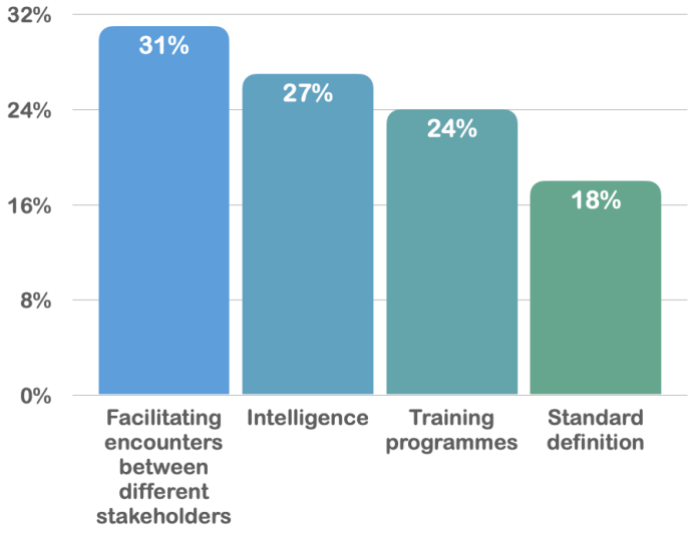

Figure 43: Most important and relevant topics as voted by participants of the Romanian workshops

SPAIN

Regarding Spain, Figure 45, Figure 46, Figure 47 show that Spain currently implements good practices on the topics of "facilitating encounters", "intelligence" and "training programmes". As for the topic number 1 (standard definition), most of respondents stated that they have not consolidated practices ongoing (50% - Figure 44), but the gap with the "YES" is shorter (42%).

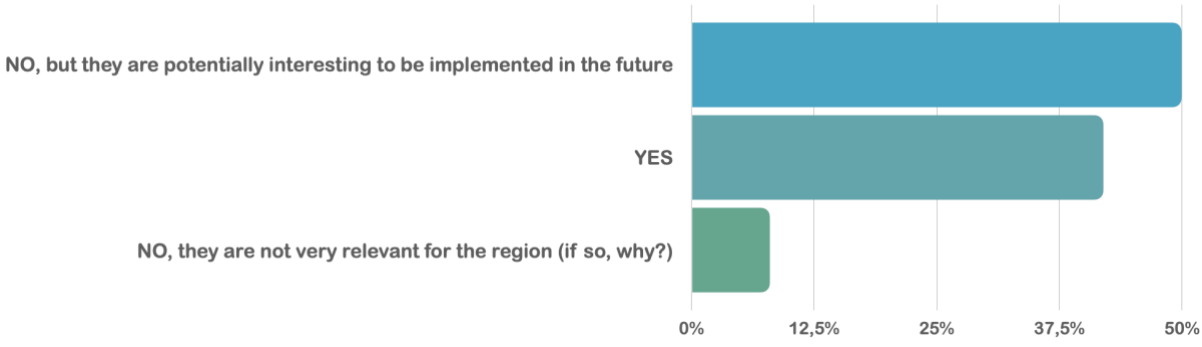

Figure 44: Standard Definition – Spain

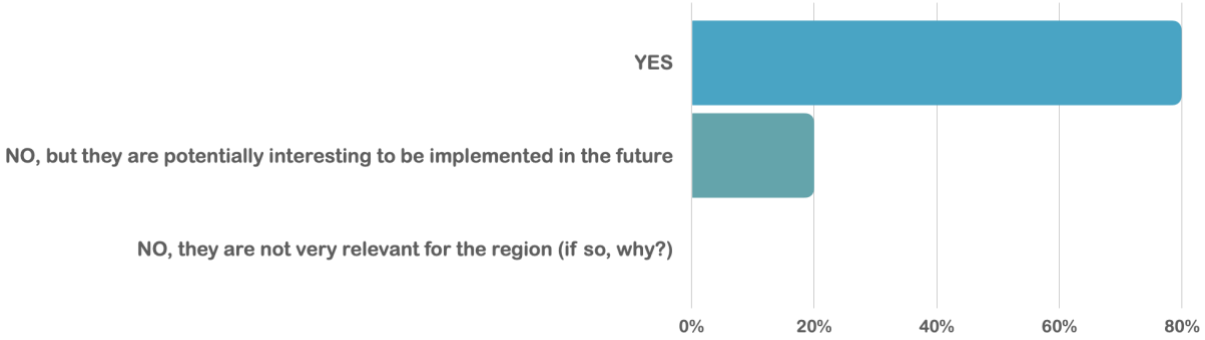

Figure 45: Facilitating encounters between different stakeholders - Spain

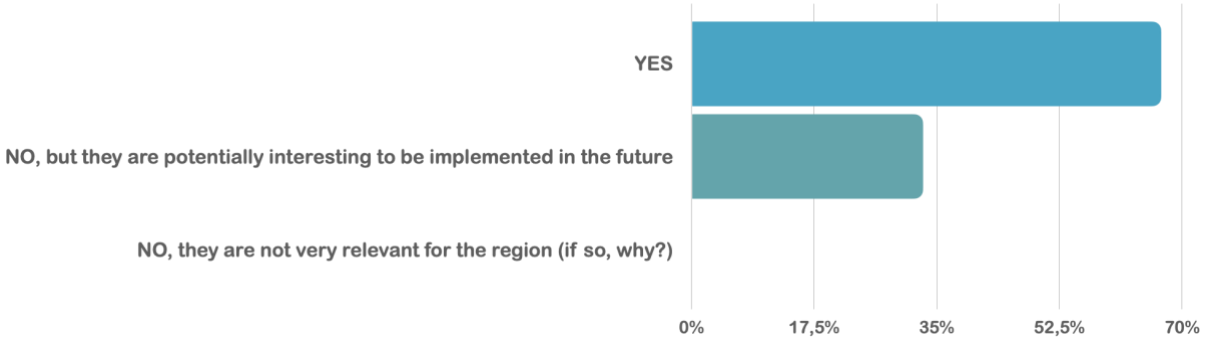

Figure 46: Intelligence – Spain

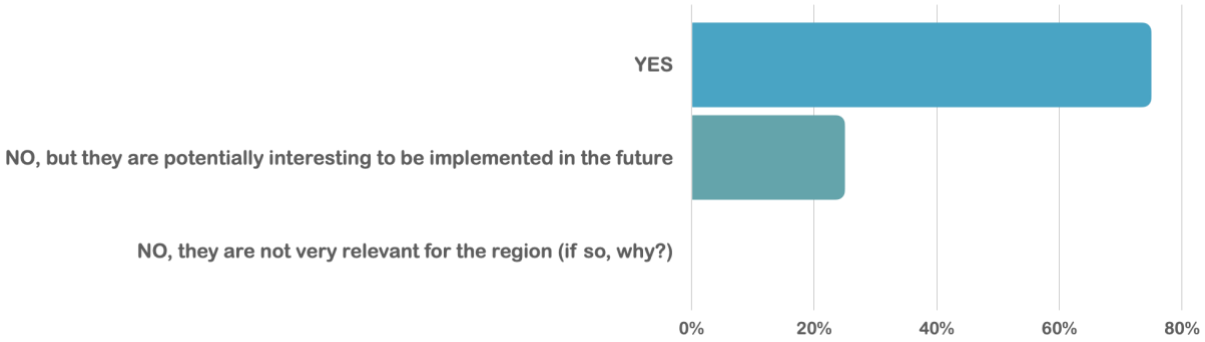

Figure 47: Training Programmes – Spain

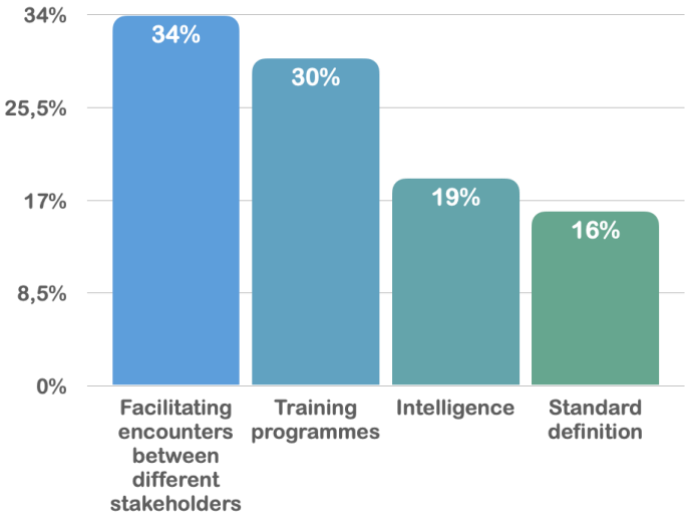

Figure 48: Most important and relevant topics as voted by participants of the Spanish workshops

APPENDIX C – ONGOING CHANGES IN THE AUTOMOTIVE SECTOR

The automotive sector provides direct and indirect jobs to 13,8 million Europeans, representing 6,1% of total EU employment. 2,6 million people work in direct manufacturing of motor vehicles, representing 8,5% of EU employment in manufacturing. The EU is among the world's biggest producers of motor vehicles and the sector represents the largest private investor in research and development (R&D)[42]; moreover, the automotive domain has an important multiplier effect in the economy: it is important for upstream industries such as steel, chemicals, and textiles, as well as downstream industries. Amongst the latter, the Europe's Automobile retail & services sector employs over 4,5 million people (Eurostat), in over 500.000 predominantly SME Companies. Over €225 Billion (BCG) come from aftermarket parts and labour revenue. The EU balance of trade, related to the Automotive sector, generates a surplus of € 74 billion (over 5,6 million vehicles exported per year)[43].

All the analysed trends in these years of the project show that mobility will continue to become increasingly digital, more connected and above all more electric and consumers who have taken sustainability into account in their purchasing decisions have led sales of electric vehicles to increase by 43% in 2020[44]. This trend is influencing, consequently, the internal organization in car manufacturers, going towards a search for new professional figures, new skills and an increase in upskilling and reskilling.

2021 has been a critical year for the automotive sector, with supply shortages, raw material price increases, and a rapid technology transformation that are putting considerable pressure on the sector. In a survey to automotive suppliers carried out in September 2021[45], only 27% show a positive outlook for the industry, however, this is up from just 8% one year ago at the outset of the COVID-19 pandemic. Yet 73% still hold a notably negative view, which is considerably higher than pre-pandemic times. Volumes are not predicted to recover during the first part of 2022, and it's still unclear if they will recover in the second half of next year, and thus profitability projections for 2021 are not expected to be met, which put at risks investments and transformation programmes.

[42] https://ec.europa.eu/growth/sectors/automotive-industry_en, November 2021
[43] ACEA, "VALUE MARKET SHARE 2020", https://www.acea.auto/figure/eu-exports-of-motor-vehicles/, November 2021
[44] "How the automotive industry is accelerating out of the turn", McKinsey, 2021
[45] https://clepa.eu/mediaroom/supply-chain-disruptions-clearly-perceived-as-largest-risk-factor-for-automotive-supply-industry/, McKinsey, CLEPA Pulse Check, October 2021

The tyre industry also suffered a major decrease in sales during the first year of the pandemic, partly driven to the slowing the original equipment market (-25%), and partly due to slowing down of the consumers (-17%) and truck and bus (-13%) demand in the replacement market. 2021 (first three quarters) showed some signs of recovery but without a clear consolidation across the market.

In the case of the UK problems relating to COVID are compounded by BREXIT. Although the BREXIT deal provides some certainty for the UK industry it has significant negative implications with additional costs for automotive manufacturers including tariffs, customs declarations, certification costs, audits to prove that rules of origin requirements are met, border delays disrupting just-in-time systems, EU customers switching to other suppliers and visa costs for EU workers[46].

These unforeseen challenges were added on top of an already rapidly changing environment, with the sector undergoing an epochal transition towards sustainable and smart mobility. The entire automotive value chain is contributing to driving such change, with immediate consequences on its work-force.

Indeed, for the automotive sector, the main Electrified, Autonomous, Shared, Connected and "Yearly" updated (EASCY[47]) trends are expected to continue to accelerate, particularly in the case of electrification; studies show that in the last 10 years companies and funds outside the automotive industry have in fact invested over 300 billion dollars[48] in EASCY. PricewaterhouseCoopers details the acronym as:

- **Electrified**: Electrification will play a key role in reaching out to the emission targets, under the condition that the electricity used to charge the vehicles will come from renewable sources to ensure CO_2 neutral mobility. Going “emissions free” will be a global initiative, and this transition to electric powertrain will have an enormous impact on the automotive industry including the restructuring of production sites and the workforce.
- **Autonomous**: The rapid progress made in areas such as artificial intelligence (AI), 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 the use of individual mobility platforms. New application scenarios are emerging that would have been unthinkable just a few years ago[49].

[46] *“The Brexit deal and UK automotive sector”, https://ukandeu.ac.uk/the-brexit-deal-and-uk-automotive, December 2020*
[47] *“Five trends transforming the Automotive Industry”, PricewaterhouseCoopers, 2017-2018*
[48] *“How the automotive industry is accelerating out of the turn”, McKinsey, 2021*
[49] *“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/*

- **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 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 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.

C.1 ELECTRIFIED

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 current opportunity to transform the “way we move into the electric" comes from changes in two main areas: **regulation** and **consumer behaviour**.

Regulation: governments and cities have introduced regulations and incentives to accelerate the shift to sustainable mobility. Regulators around the world are setting stricter emission targets. The European Union has unveiled its "Fit for 55"[50] program, which seeks to align climate, energy, land use, transportation and tax policies to reduce net greenhouse gas emissions by at least 55% by 2030, and the USA Biden administration has introduced a target of 50% electric vehicles (EVs) by 2030[51] and in addition, most governments around the world, also offer EV subsidies. The current proposal, under

[50] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/package-fit-for-55, 2021
[51] https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/, 2021

discussion within the EU, would condition the availability of technology-choices and the impact on the workforce associated with the development of this technology. Also, the availability of re/charging, as infrastructure would support the drive the demand.

Consumer behaviour: consumer behaviour and awareness are changing as more and more people accept alternative and sustainable modes of mobility. Today, more than half the world's population lives in major cities and this trend is growing[52]. Mobility services like car-sharing and ride-hailing will be increasingly important, as the increase in traffic means mobility has to become more individualised[53]. Coupled with this, younger generations no longer want to own a car[54]; parking has become more crowded in cities and the use of congestions-taxes is increasing. These trends are confirmed as trips to the city centre with shared bicycles and e-scooters increased by 60% year-on-year[55] The industry has attracted over $400 billion in investment over the past decade, including about $100 billion since the beginning of 2020. All this money is aimed at companies and start-ups working on the electrification of mobility, vehicle connection and autonomous driving technology[56]. Interestingly, whilst consumers seem to have developed a more attentive behaviour towards sustainability when it comes to the choice of the modes and modalities of transport, this seems to be less the case when it comes to the maintenance of existing vehicles. A case in point is that of tyres, where a study by Lizeo[57] showed that the main driver of choice remains price. This is despite the presence since 2012 of the tyre label, which would allow consumers to choose their tyres in function of their performances with regard to fuel efficiency (rolling resistance), safety (wet grip) and levels of external noise. Therefore, the market uptake of technologies which could contribute to the Green Deal ambitions remains low.

The transformation of the automotive industry towards electrification will lead to huge changes across the entire supply chain and create a significant transformation in the size of the market for automotive components.

Critical components for electrification such as electric batteries, drives, and LiDAR (Light Detection and Ranging) sensors and radar sensors will be worth about 52% of the total market size by 2030. Components used only for Internal Combustion Engine (ICE) vehicles such as conventional

[52] https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html
[53] *"Rethinking on-demand mobility", ADL, 2020*
[54] *"Global Automotive Consumer Study - The changing nature of mobility, exploring consumer preferences in key markets around the world", Deloitte, 2014*
[55] *"Shared mobility: Where it stands, where it's headed", McKinsey, August 2021*
[56] *"Mobility's future: An investment reality check", McKinsey, April 2021*
[57] *European Tyre Labelling 2012-2020, https://www.etrma.org/wp-content/uploads/2021/04/ETRMA-UPDATED-LIZEO-REPORT-2021.pdf, February 2021*

transmissions, engines and fuel injection systems would see a significant drop to around 11% by 2030 (about half the size of 2019 levels). Such a drastic change will force traditional component players to adapt quickly to compensate for the decrease in revenue streams as the scale of the disruption will be significant as more than 100.000 jobs will change just in the German automotive industry by 2030[58].

According to the PwC Strategy & study[59] the automotive suppliers alone employ around 600.000 workers whose work depends on the internal combustion engine. The production of battery electric vehicles will create new employment opportunities, but overall is less labour intensive. The study highlights that 501.000 jobs are at stake in the ICE domain, net loss of 275.000, including gains in EV powertrain[60]. This is 84% of the current workforce in the ICE domain lost until 2040. Half a million also represents about 1/3 of the overall current workforce of 1,7 million.

C.2 AUTONOMOUS

The software will be the main differentiator in the automotive industry in the coming years[61]. Main OEM players must make significant changes in technology, competitive dynamics and skills. EASCY megatrends will push software to the forefront and the main technological drivers in autonomous driving (AD), connectivity, electrification and shared mobility will transform vehicle electronics and software architecture requirements over the next decade. To quickly realize these expectations, OEM need a scalable, flexible and robust platform for vehicle electronics and software. However, companies pursuing this goal also face a substantial risk: electrical and electronic technology for the automotive industry will continue to become more centralized and consolidated. For example, fourth-generation systems (see Figure 18) will have centralized domain controllers, and fifth-generation systems will employ a combination of cross-domain vehicle computers and zone controllers. Cross-domain vehicle computers will centralise functionality, which in today's third-generation systems works on different electronic control units (ECUs), while zone controllers primarily act as gateways and consolidate input and output capabilities for a specific area within the vehicle[62].

[58] *"Transformation in the Automotive Industry – What Skills Are Needed?" Institute for Economic Research (IFO), 2021*
[59] *"Electric Vehicle Transition Impact Assessment", https://clepa.eu/who-and-what-we-represent/ev-transition-impact-assessment/*
[60] *based on the studies, most of future value-add in powertrain technologies (70%) depends on EU battery production*
[61] *"Rewiring car electronics and software architecture for the Roaring 2020s", McKinsey*
[62] *"Rewiring car electronics and software architecture for the Roaring 2020s", McKinsey*

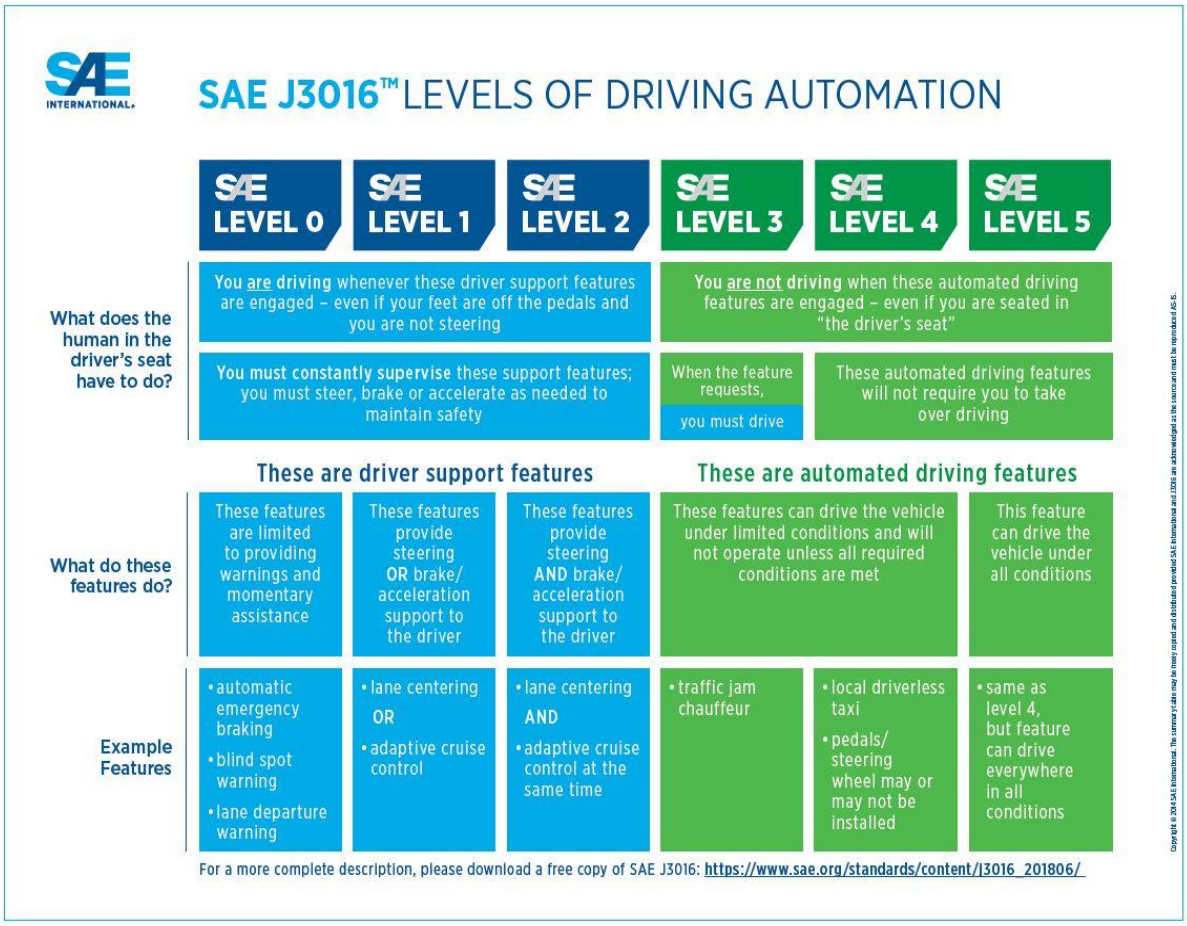

Figure 49: SAE J3016 "Levels of Driving Automation" standard for consumer

In the automotive industry, therefore, a profound change has been taking place linked to the awareness that cybersecurity is a mandatory element of the development of an increasingly digital product and increasingly part of the complex mobility ecosystem, which requires a strong connection and an ever-greater integration of all its components and actors. The next few years will see cybersecurity enter the automotive industry as a result of the implementation of the Unece R155[63] regulation, through the definition of a roadmap and obligations for car makers with respect to cyber security; Among other things, UNECE has approved a second regulation (R156) that regulates, always in the automotive field, the safety in updating software in "over the air" mode.

[63] *UNECE, https://unece.org/transport/documents/2021/03/standards/un-regulation-no-155-cyber-security-and-cyber-security, October 2021*

These developments do not concern only the vehicle as such, but also its components – which are essential both for the different phases of the vehicle automation, but also for services of the connected vehicle. In this context and in view of the upcoming UNECE Regulation 155, it will be key that a secure **standard** access to the vehicle data and resources will be granted to allow those applications that require a constant and expedient access to in-vehicle data. For this, industry awaits a sector specific legislative framework (under type approval) to regulate access to in-vehicle data. This would allow players in the whole value chain to continue developing new services and applications further enhancing the competition within the sector and the competitiveness of the European automotive sector world-wide.

C.3 SHARED

The vehicle of the future will be "a place to do activities", by taking 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)[64], but the huge amount of information that is expected to be exchanged.

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". New generations are not devoted to their "own car" and so do not need a driving licence to use it. Moreover, the traffic increase in the major European capitals will require a new approach to mobility.

According to McKinsey, it is possible to segment the shared-mobility market along seven mobility verticals, depending on vehicle-ownership structure (private versus fleet vehicles), whether the customer is driving or being driven, and whether or not rides are shared with strangers (pooled or non-pooled)[65].

[64] *"What kind of data can my car share?" CarDataFacts.eu, 2017, http://cardatafacts.eu/data-can-car-share/*
[65] *"Shared mobility: Where it stands and where it's going", McKinsey, 2021*

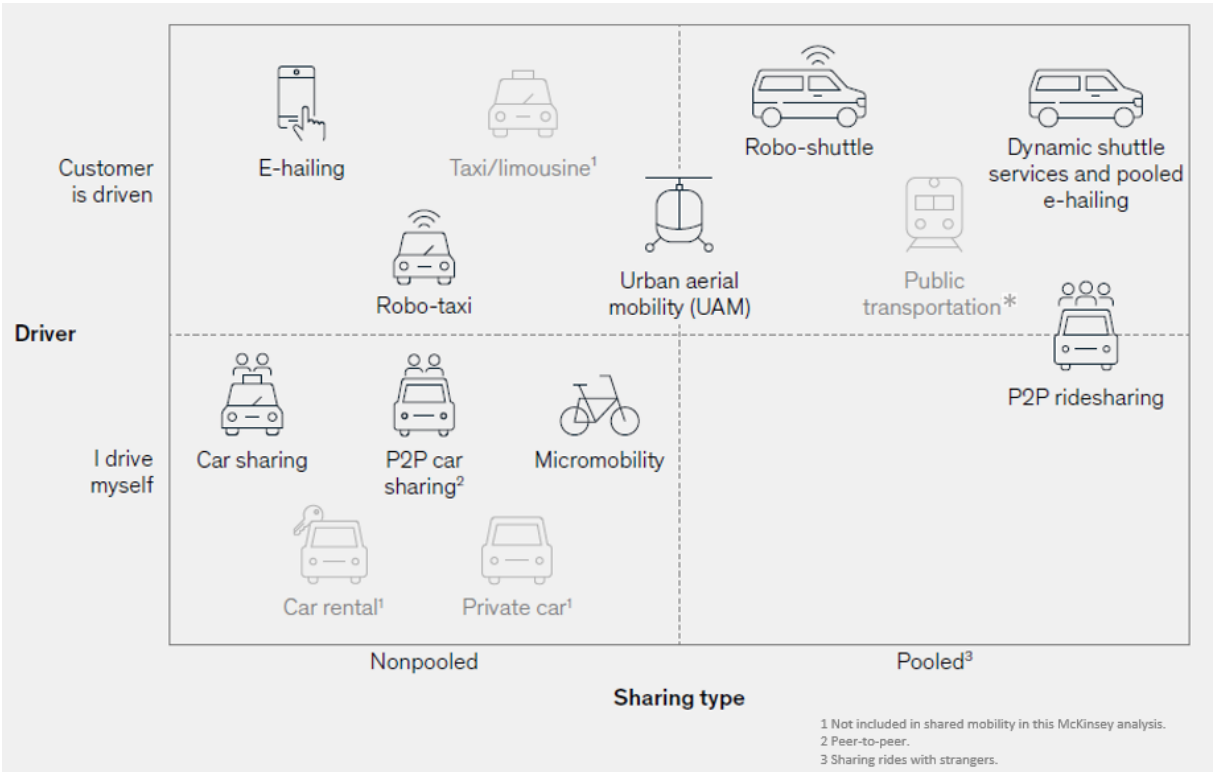

Figure 50: shared mobility segmentation (Source: McKinsey Centre for Future Mobility)

- **E-hailing:** in e-hailing, also called ride-hailing, riders order a car to pick people up via a virtual device. The driver, who in some regions does not need a business license, picks up the passenger and drives to the designated location.
- **Dynamic shuttle services and pooled e-hailing:** riders order car service via their mobile device and share rides with other passengers. The driver picks up passengers at itinerary-based locations and drives passengers to their drop-off points in an order that is optimized based on the itinerary.
- **Car sharing:** customers use cars provided by a company for shorter periods of time than rental, generally remaining in a geographically limited area. Sharing models can be free-floating (with cars picked up and dropped off anywhere) or station based, with cars returned to a dedicated location.
- **Peer-to-peer (P2P) car sharing and ridesharing:** in P2P car sharing, car owners allow other drivers to use their vehicles for a charge. In P2P ridesharing, private-car owners drive paying passengers to their destination, mainly long distance.
- **Shared micromobility:** very light vehicles (for example, kick scooters, bicycles, or electric scooters) offered for shared use to the public for a fee, either free-floating or station based.

- **Aerial mobility:** flying taxis (powered by electricity or new energy) move people by air between dedicated stations, either piloted or semiautonomous.
- **Robo-taxis and shuttles:** robo-taxis and shuttles serve the same function as today's e-hailing and taxi services but substitute autonomous-driving technology for the human driver. Many companies, including start-ups, are investing in the research and development of this technology—not only in the automotive industry but also in the mobility industry, high-technology industry, software industry, and others. Because driver salaries make up about 40 to 50 percent of trip fares today, robo-taxi services are expected to become price competitive to driver-based services—and perhaps even to the total cost of owning a car.

Generally speaking, the sharing macrotrend is fact. According to Deloitte[66] - which has developed a model that enables the outlining of four different future mobility scenarios, this is driven by 2 Drivers of Change already ongoing in the automotive sector: technology and habits of transport users (the time needed for these scenarios to become established may vary and they may even coexist).

In the first scenario ("Incremental change"), increasingly connected vehicles owned and still controlled by the driver enable an easier and interactive driving experience.

The second scenario ("A world of sharing") envisages consolidation of shared mobility phenomena. The gradual shift from ownership to shared use is complemented with a "hybrid" type of mobility, namely Long-Term Rental (LTR) schemes. Indeed, rental is a mobility option that reflects the needs of many users as it enables car possession without the constraints associated with car ownership.

The third scenario ("The driverless revolution") represents the stage when autonomous driving becomes a viable, safe and affordable option but car ownership still prevails.

In the fourth scenario ("Shared autonomous"), autonomous driving and car-sharing converge.

[66] *"Mobility Boost, a new phase coming (COVID-19, Future of Mobility Impacts)", Deloitte, 2020*

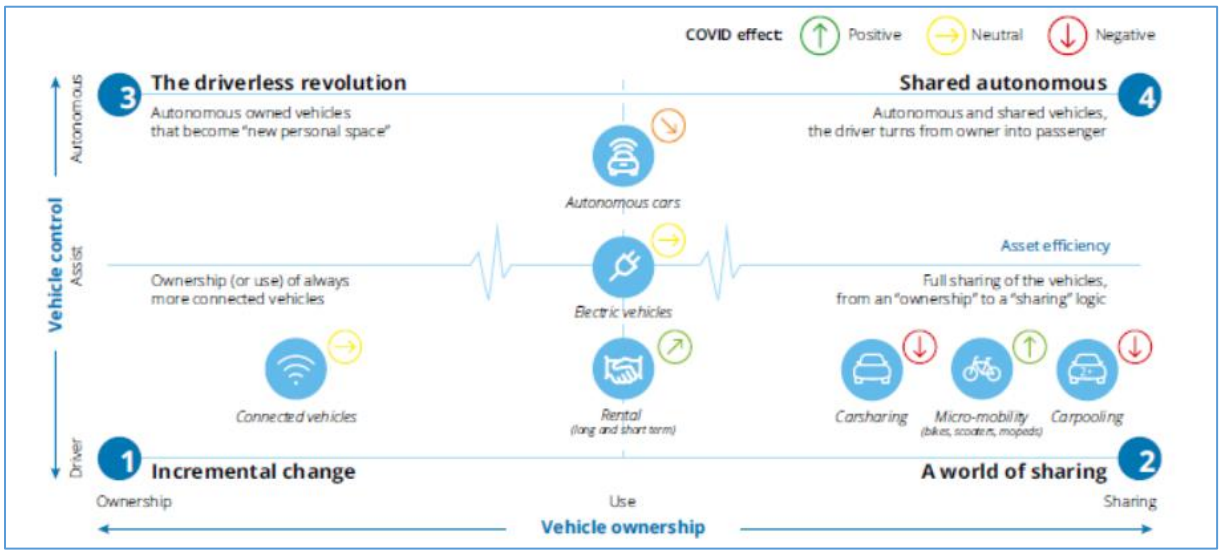

Figure 51: Future of Mobility™ model about the mobility evolution (source: Deloitte)

C.4 CONNECTED

According to Capgemini[67], "connectivity is the biggest single enabler of change. It is only through connectivity that the potential of the other trends (EASCY) can be realized" as the entire way people and goods travel from point A to point B is changing, driven by a series of converging technological and social trends: the rapid growth of carsharing and ridesharing; the increasing viability of electric and alternative powertrains; new, lightweight materials; and the growth of connected and, ultimately, autonomous vehicles. The result is the emergence of a new ecosystem of mobility that could offer faster, cheaper, cleaner, safer, more efficient, and more customized travel[68].

The market for connected cars is predicted to soar to over $215 billion by 2027[69] and V2X is potentially safer for road users, and less harmful to the environment; with the demand for greater connectivity set to soar, 5G-enabled connected cars will become the new norm. As a result, the future of a vehicle is fundamentally changing from a tool used to move people from A to B, to an integrated, fully-connected hub.

This trend will not only change the relationship of consumers with the vehicle as a whole, but also set a new relationship with the manufacturers of those components that are changed several times during the lifetime of a vehicle, such as tyres. These, through direct access to in-vehicle data, will be able to offer products tailored to the specific use, environment and driving style of the consumer, but also

[67] *"Connected vehicle trend radar", Capgemini, 2019*
[68] *"Forces of change: the future of mobility", Deloitte, 2017*
[69] *"Why the future for cars is connected", World Economic Forum, 2021*

inform the driver concerning the interaction of the vehicle with its environment. This will improve the overall performance of the vehicle and will further limit its environmental impact, whilst improving its safety.

Vehicle prognostics, maintenance and repair are increasingly becoming software driven. Services such as predictive maintenance (i.e., avoiding a breakdown), remote diagnostics, parts pre-ordering and software updates well represent the impact of the "connected vehicle" on the complete downstream value chain, enabling new business models such as maintenance as a service, tyre as a service or connected roadside assistance. Traditional businesses such as car insurance are also increasing leveraging insights on driver behaviour to adapt their premiums, and Public Authorities also have opportunities to improve market surveillance of the vehicle fleet in-operation and in-service conformity monitoring through secure, real-time access to vehicle data and functions, thereby improving the vehicle's safety, security and environmental impact[70].

Public charging points that refill EVs will have to rise significantly to meet the global EV-adoption increases forecast by 2030[71]. 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.

Connectivity goes through "Big Data", which 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), other challenges come into play, such as safe ways to grant direct access to in-vehicle data as well as h new ways of managing data.

Connected vehicles raise multiple security concerns. On the road, they're vulnerable to hacking. A modern vehicle is effectively a data centre containing 100+ interconnected servers, control units, sensors, and so on with many of the connections being wireless ones[72]; telematics and infotainment modules may be linked to safety-relevant modules.

[70] *Creating a level playing field for vehicle data access: Secure On-board Telematics Platform Approach* https://www.etrma.org/wp-content/uploads/2021/03/S-OTP-Paper.pdf
[71] *"Three surprising resource implications from the rise of electric vehicles", McKinsey, 2018*
[72] *"Reinventing Cybersecurity with Artificial Intelligence: The new frontier in digital security", Capgemini, July 2019.*

C.5 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.

The "yearly updates" arise from the high speed of innovation of the other "EASCY" dimensions, especially in the field of "Autonomous", "Electric" and of course "Connected" – fundamental technical improvements are already happening in such quick succession that they can no longer be integrated into the classic model cycles. Instead of the more cosmetic exercise of "model years," the automotive industry will have to keep bringing out "annual models" using the latest technology – in some cases including the option of retrofitting earlier annual models to bring them up to date. The same process that today is customary in software for computers or smartphones.

Product manufacturers use OTA (over-the-air) updates to deliver critical information to devices and ensure that all software is properly working and for vehicles; OTA updates eliminate the need to visit a dealership service centre for owners and the updates are sent via a wireless connection and installed automatically.

There are two primary categories of OTA updates for cars[73]: infotainment and drive control. **Infotainment** updates refresh map information, supply audio upgrades, and add new interfaces, app versions, streaming services, features, and more. Infotainment updates improve the in-car experience but are not mission-critical.

Drive control updates, affect a vehicle's ability to operate safely and properly as it moves down the road. These updates can include system enhancements or corrections to powertrain systems, chassis systems, and advanced driver assistance systems (ADAS).

C.6 THE CHIP SHORTAGE ISSUE

Among the causes of the so-called chip crunch is the COVID-19. During 2020 people were forced to stay at home due to lockdown and as a result they started the mass purchase of electronic devices, all products united by the presence of chips. However, the automotive industry has suffered a strong

[73] *"What Are Over the Air Updates for Cars?", www.jdpower.com, 2021*

contraction reducing orders, production and planning. All the major microchip manufacturers faced with the increase in demand from manufacturers of electronic devices and the contraction in demand from car manufacturers at the beginning of the pandemic, have therefore begun to schedule production and orders for the electronics sector rather than the automotive sector.

To exacerbate the problem, during early 2021 Renesas Electronics[74] suffered a fire that stopped production, with extensive damage that reduced the global supply. This at the same period as the Container Ship Ever Given runs aground in the Suez Canal[75] blocking the passage to all ships and sending an important slice of world ship transport into crisis.

Due to these reasons, the shortage in the supply of semiconductors has shortly reached significant dimensions for the automotive industry where electronics and its components like microchips now has a value for more than 30% of the vehicle cost (and value is set to rise due to the EASCY megatrends, especially for the Electric, Autonomous and Connected drivers). A shortage that will put more than 2 million vehicles at risk by the end of the 2021[76].

The current crisis should raise awareness of the opportunities for a policy that builds on the global leadership of the EU's automotive sector to stimulate growth in sectors like the semiconductor industry that are integrated in the wider automotive ecosystem. Strengthening the EU's economic framework with an industrial and innovation policy framework that plays to the strengths of the EU's industrial sector and increases the region's attractiveness for semiconductor related investment should be considered. A strategy will be successful if policy makers and industry build on existing strengths, maintain a global market scale for production and cooperate with industry on the basis of technology openness, ambitious objectives and the right framework conditions. The competitiveness of Europe's automotive supply chain depends on its integration in the global supply chain and therefore requires an economy that remains open for investment and a trade policy that enhances access to markets for sourcing and export. A robust industrial policy could help address global supply chain risks and counteract distortions of the level playing field in critical areas of value creation, notably semiconductor technologies. It will be critical to look beyond chip production capacity alone as chip fabrication plants are unlikely to survive without a supporting ecosystem of chip design and application technologies.

[74] *Reuters.com, https://www.reuters.com/technology/renesas-restore-fire-hit-chip-plant-100-capacity-around-mid-june-2021-06-01/, 2021*
[75] *Reuters.com, https://www.reuters.com/world/ever-given-container-ship-set-leave-suez-canal-2021-07-07/, 2021*
[76] *"Chip, perché non ce ne sono più? Le ragioni della crisi (e gli effetti su di noi)", Corriere.it, 2021*

Investing in a skilled workforce and a leading research ecosystem should be prioritised: Private sector developments should be linked with a strong ecosystem of public and private research hubs and the EU has catching-up to do when it comes to activities of importance for the digital economy. The EU underperforms China and the US in the number of leading universities on AI and computer science degrees per million inhabitants and more EU citizens with a PhD degree work outside the EU than the number of non-EU PhD's working in the EU10. The availability of a skilled workforce will be both necessary to develop applications of advanced semiconductor technology and create sufficient demand. Skills will also play a critical role to attract investment in semiconductor chip production. Whereas in automotive components as a whole proximity to markets and customers influenced 42% of investment decisions since 2010, for semiconductors proximity to customers was with 23% less important than availability of skilled workforce, which was the leading motivation for 65% of investment decisions. The availability of a skilled workforce plays a key role in investment in the overall automotive supply industry too, being the primary motive for 42% of investments[77].

C.7 INDUSTRY 4.0 INTO AUTOMOTIVE SUPPLY CHAIN

Analysing more specifically the sale of cars, during the pandemic due to COVID-19, the worldwide retail dealers' network radically changed the approach to sales and technology proved to be an important ally: some dealers closed their showrooms to the public and interacted with customers by phone, by videoconference and/or by private appointment. Potential buyers took advantage of web sites and apps that helped them explore and organize the purchase of cars and all related services, such as financing and insurance.

The same dynamics seen in B2C have also developed in B2B and the entire automotive supply chain is growing in the digital approach, even after the end of COVID-19[78] as other factors are literally putting the supply chain under tension. These include the international geopolitical crises, the shortage of microchips and even the recent blockade of the Suez Canal are being felt throughout the whole supply chain. Good practices learned during the pandemic are now useful in these situations.

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

[77] https://clepa.eu/wp-content/uploads/2021/10/CLEPA-position-on-semiconductors-final2-updated.pdf, *CLEPA, October 2021*

[78] *"How the automotive industry is accelerating out of the turn", McKinsey, 2021*

well as operations and performance"[79], with the value chain subjected to OEMs platform standardization and industry consolidation and integration[80].

The European Green Deal aims to make the European economy environmentally sustainable by 2050[81]. The intermediate targets for 2030 include, as a minimum, a 40% cut in greenhouse gas emissions, 32% of energy from renewable sources and a 33% increase in energy efficiency[82]. For automotive suppliers, OEMs, distributors, dealers and customers, the transition to clean energy has become critical. While in the past the value chain for machinery and equipment was extremely linear (suppliers ship components to OEMs, OEMs produce vehicles -and parts-, and dealers and distributors provide cars, parts and repair services to customers), today the necessity to carry out the energy transition is disrupting segments of the value chain and altering their mutual interactions.

The issue of digitalization in the automotive sector requires a clarification because we are talking about a particularly complex industrial sector, strongly integrated with the extremely diversified supply chains: 75% of the components of a car are made by subcontractors and subsequently assembled by car manufacturers[83].

This is why it becomes essential to develop first of all a collaboration towards new common standards of production of semi-finished products, components and finished products because the need is to innovate at every level of the supply chain, investing in intelligent and flexible solutions for the benefit of all the involved stakeholders by exploiting the so-called "industry 4.0".

The wording "4.0" refers to the arrival of a fourth industrial revolution, following the invention of the steam engine and the mechanical loom of the 1900s, the exploitation of electricity and mass production at the beginning of the twentieth century and the introduction of computers and computer science in production after the Second World War; moreover, this is the fourth profound transformation in the world of production[84], after the lean production of the 70s, the outsourcing of the 90s and the automation implemented in the 2000s and the result of this extraordinary revolution is the so-called Factory 4.0 that exploits the potential of interconnected machinery, which performs self-diagnostics and preventive maintenance.

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[79] *"Cracking the code for global supply chain management", extract from <<Big data and analytics in the automotive industry>>, Deloitte, 2015*
[80] *"Perché FCA ha venduto Magneti Marelli ai giapponesi di Calsonic", IlSole24Ore, 2018*
[81] *"EU climate action and the European Green Deal", European Commission, ec.europa.eu*
[82] *"2030 climate & energy framework" European Commission, ec.europa.eu*
[83] *"Automotive 4.0: le tecnologie digitali fanno l'auto del futuro", Eletricomagazine.it, https://elettricomagazine.it/ondigital-digitalizzazione/automotive-4-0-tecnologie-digitali-industria-auto/, 2021*
[84] *"Manufacturing next act", McKinsey, 2015*

The elements pushing digitalization into the automotive sector are many: from the energy transition to smart manufacturing, from mass customization to the reduction of time to market, from control and maintenance software to driver assistance technologies, adding the transversal issue of the 2030 objectives of sustainability and carbon neutrality.

The digital transformation that supports Industry 4.0 represents "the solution" of all these trends: intelligent technologies allow you to improve performance in the short and long term, monitor plants, track every component of the supply chain that can be simplified through four main area of intervention for the connected factory in the automotive domain[85]:

- **Interconnection**: with wireless communication technology and the capabilities of the IoT, it is possible to connect machinery, sensors and other devices to people, greatly increasing the effectiveness and efficiency of the process (inside a company and / or between different companies);
- **Transparency** (of information): the transparency offered by Industry 4.0 provides operators with a large amount of useful information necessary to make appropriate. In synergy with interconnectivity, this allows operators to collect immense amounts of data and information decisions (big data availability) from all points of the production process, thus helping functionality and identifying key areas that can benefit from innovation and improvement;
- **Decentralised decisions**: the interconnection and transparency of information allows operators to make decisions both inside and outside production facilities. This ability to combine local and global information simultaneously helps drive better decision-making and increase overall productivity;
- **Technical assistance**: Industry 4.0 shifts the role of man from a machine operator to the one who makes decisions and solves problems. Assistance 4.0 systems are designed to support operators who need to make complex decisions to solve problems that are often urgent and at short notice. Regarding one of the last steps of the automotive supply chain (aftermarket) it is a fact that ADAS and autonomous vehicles are expected to reduce aftermarket revenues[86] and a shift between car-damage-repair to car-predictive-maintenance is expected; big data and advanced analytics (assistance 4.0) will 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[87]. The real innovation for brands, will be to invest in an efficient and

[85] *"Industria 4.0: quando innovazione e industria si incontrano", https://top-engineer.it/automotive-4-0-quando-innovazione-e-industria-si-incontrano/, Top-Engineer, 2020*
[86] *"Ready for inspection – the automotive aftermarket in 2030", McKinsey, 2018*
[87] *"Ready for inspection – the automotive aftermarket in 2030", McKinsey, 2018*

effective after-sales service that exceeds customer expectations: 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)

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[88]. 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[89]. These, in turn, if the right conditions are granted, will allow immediate feedback to the driver and public authorities on the state of the infrastructure and will facilitate interaction between vehicles both in view of further stages of automation for consumers, but also for business applications, such as truck platooning.

[88] *"The future of the Automotive Value Chain – 2025 and beyond", Deloitte, 2017*
[89] *"A road map to the future for the auto industry, McKinsey", 2014*