DRIVES

Development and Research on Innovative Vocational Education Skills

Skill Needs and Gaps

Deliverable 2.8

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LIST OF ABBREVIATIONS

ABBREVIATION	MEANING
3D	Three-dimensional
ADAS	Advanced Driver-Assistance Systems
AI	Artificial Intelligence
AVG	Average
BASE	Big Data, ADAS and After sales, Supply chain and Sharing, Electrification
BEV	Battery Electric Vehicle
CAD	Computer-Aided Design
CEO	Chief Executive Officer
CO2	Carbon Dioxide
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
EPRS	European Parliamentary Research Service
EQF	European Qualifications Framework
ESCO	European Skills, Competences, qualifications and Occupations
EU	European Commission
EV	Electric Vehicle
HEV	Hybrid Electric Vehicle
HQ	Head Quarter
HR	Human Resource
IT	Information Technology
IVET	Initial Vocational Education and Training
KPI	key Performance Indicator
NACE	Nomenclature statistique des Activités économiques dans la Communauté Européenne
OEM	Original Equipment Manufacturer
R&D	Research & Development
R&D&I	Research & Development & Innovation
SME	Small Medium Enterprise
TVET	Technical and Vocational Education and Training
V2X	Vehicle to Everything
VET	Vocational Education and Training
WP	Work Package

Table 1 List of Abbreviations

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1 INTRODUCTION

This report is the deliverable D2.8 Skill needs and gap Report of the Development and Research on Innovative Vocational Educational Skills project (DRIVES), the Blueprint for Sectoral Cooperation on Skills in the Automotive sector.

Based on the previous questionnaire (Demand) the structure of this report and interaction with stakeholder is aligned with the KPIs used in both the "Demand" survey and D2.7 Forecasting dissemination Report[1], in order to enable analysis of the differences between skills demand and skills provision serving the automotive sector. The KPIs are grouped under the following headings:

- Sample characterisation
- Drivers of Change
- Skills
- Job Roles
- VET provision mechanisms
- Recognition and qualification
- Recruitment and attractiveness

And all the questions and relative KPIs (where available) have been analysed by overall value and filtered by the following selected categories of stakeholders:

- **VET**: including VET schools, Colleges and Universities
- **INSTITUTE**: including Research institute and Accreditation centre/qualification body
- **PRIVATE**: all private companies (excluding other categories above)
- **UMBRELLA ORGANISATION**: association of institutions, who work together formally to coordinate activities or pool resources

A total of 83 respondents completed, or partially completed the survey. Only those respondents completing at least the Drivers of Change section were included for further analysis; the survey was disseminated to EU partner countries through project channels and partners networks, such as European umbrella associations and national associations and their members.

The Drivers of Change "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES" was most likely to be identified as 'most important' of respondents indicating this was the case, followed by

[1] *Deliverable D2.7 Forecasting dissemination Report, DRIVES Project, www.project-drives.eu*

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"STRUCTURAL CHANGE", meanwhile "STRUCTURAL CHANGES" was the Driver of Change most likely to be ranked first in terms of the level of urgency.

The relative importance attached to different Drivers of Change by respondents to both surveys (Demand & Offer) were quite similar with „STRUCTURAL CHANGES" identified as most important driver; in term of urgency, again "STRUCTURAL CHANGE" has been identified by both as very urgent (by 2020) even if, generally speaking, 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.

Related to the skills evaluation, the BIG DATA/DATA ANALYTICS skill is ranked first with a significant gap to the second highest score. Based on the categorisation adopted this skill is closely related to DIGITALISATION; SOFTWARE DEVELOPMENT is ranked second and can be termed a TECHNICAL skill; TECHNICAL KNOWLEDGE (another TECHNICAL skill) is in third place with a relatively high AVG number of graduates. Comparing TOP 10 Demand (of skills) with the Offer, only 3 skills are matched; it is necessary to increase the range from TOP 10 to TOP 20 into the Offer list to find at least 5 similarity.

The necessity of interaction regarding this topic is essential to build a common strategy for the future and this is underlined also in the best provision mechanism approach: both „Demand" and „Offer" replies highlight the importance of "TRAINING ON THE JOB" as the most effective VET approach, where all parties are involved together to build a common strategy and the same outcomes appers from another section related to the best recruitment method where respondents from both the Offer and Demand surveys identify"COOPERATION BETWEEN THE INDUSTRY AND EDUCATION" as the most important method.

The necessity for "standard(s)" across the EU Automotive sector to enable movement of skilled workers between EU countries and recognition of skill levels relating to training undertaken to support increased mobility of workers is a key focus of the DRIVES project. Even if a pre-determined list of the most recognised standard and qualification frameworks was included in the questionnaire, it is important to underline that a list of "NATIONAL" standards are still considered essential and a further investigation on this topic will be necessary during project lifespan.

Focuses on overall key performance indicators related to "recruitment and attractiveness methods" in relation to the automotive industry the "COOPERATION BETWEEN THE AUTOMOTIVE INDUSTRY AND THE RELEVANT EDUCATION STAKEHOLDERS" for this domain is considered of primary importance.

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Chapter 2 "KPI INTRODUCTION" introduces the list of indicators used to analyse the outcomes of the "Offer" survey (Key Performance Indexes).

Chapter 3 "MAIN GOALS AND STRATEGY ADOPTED" outlines the overall research and intelligence work programme implemented throughout the DRIVES project, as context for consultation with VET stakeholders.

Chapter 4 "CURRENT VET IN EUROPE" offer a view of the European VET system in 7 countries, based on a desk-research activity made by DRIVES partners. This activity has been done to increase the accuracy of the Offer survey. Analysed country are:

- Czech Republic
- Germany
- Italy
- Slovakia
- Spain
- Sweden
- United Kingdom

In the same chapter is also available a brief description of the harmonisation process used to ensure clear and useable data for analysis of the Offer survey.

Chapter 5 "SURVEY AND DESK RESEARCH EXPLANATION" introduces the structure of the "offer" survey and its constituent parts.

Chapter 6 "RESULT OF THE SURVEY", follows the structure of the survey in terms of sessions and questions and analyse the replies per KPIs and filtered by different point of view; all questions and relevant KPIs (where possible) have been analysed by overall value and filtered by the following selected categories of stakeholder:

- VET: including VET schools, Colleges and Universities
- INSTITUTE: including Research institutes and Accreditation centres/qualification bodies
- PRIVATE: all private companies (excluding other categories above)
- UMBRELLA ORGANISATION: associations of institutions, who work together formally to coordinate activities or pool resources

All KPI are analysed and compared between Demand and Offer to evaluate the current gap.

More detailed information discussed into this report can be found in the Appendix.

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2 KPI INTRODUCTION

The Questionnaire has been analysed with reference to a number of different KPIs as indicated in Table 2.

These are clustered into seven groups following the structure of the Questionnaire and are aligned with the KPIs used in both the "demand" survey and D2.7 Forecasting dissemination Report[2] in order to enable analysis of the differences between skills demand and skills provision serving the automotive sector. The KPIs are grouped under the following headings:

- Sample characterisation
- Drivers of Change
- Skills
- Job Roles
- VET provision mechanisms
- Recognition and qualification
- Recruitment and attractiveness

#	CATEGORY	KPI	INDICATOR TITLE	UOM
1	SAMPLE CHARACTERISATION	1.1	N° OF RESPONDENTS	N°
1	SAMPLE CHARACTERISATION	1.2	CATEGORY	%
1	SAMPLE CHARACTERISATION	1.3	CATEGORY BY TYPE	%
1	SAMPLE CHARACTERISATION	1.4	RESPONDENTS PER COUNTRY	%
1	SAMPLE CHARACTERISATION	1.5	RESPONDENTS JOB TITLE	%
1	SAMPLE CHARACTERISATION	1.6	COURSES PROVIDED	%
1	SAMPLE CHARACTERISATION	1.7	LANGUAGES PROVIDED	%
1	SAMPLE CHARACTERISATION	1.8	LEARNERS ATTEND	%
1	SAMPLE CHARACTERISATION	1.9	EQF OFFERED	%
2	DRIVERS OF CHANGE	2.1	IMPORTANCE OF DRIVERS OF CHANGE GROUPS	%
2	DRIVERS OF CHANGE	2.2	URGENCY OF DRIVERS OF CHANGE GROUPS	%
2	DRIVERS OF CHANGE	2.3	DoC NEW TECHNOLOGIES AND BUSINESS MODELS: IMPORTANCE	%
2	DRIVERS OF CHANGE	2.4	DoC NEW TECHNOLOGIES AND BUSINESS MODELS: URGENCY	%
2	DRIVERS OF CHANGE	2.5	DoC CLIMAT GOALS, ENVIRONNEMENTAL […]: IMPORTANCE	%
2	DRIVERS OF CHANGE	2.6	DoC CLIMATE GOALS, ENVIRONMENTAL […]: URGENCY	%
2	DRIVERS OF CHANGE	2.7	DoC SOCIETAL CHANGES AND […]: IMPORTANCE	%
2	DRIVERS OF CHANGE	2.8	DoC SOCIETAL CHANGES AND […]: URGENCY	%
2	DRIVERS OF CHANGE	2.9	DoC STRUCTURAL CHANGES: IMPORTANCE	%

[2] *Deliverable D2.7 Forecasting dissemination Report, DRIVES Project, www.project-drives.eu*

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#	CATEGORY	KPI	INDICATOR TITLE	UOM
2	DRIVERS OF CHANGE	2.10	DoC STRUCTURAL CHANGES: URGENCY	%
2	DRIVERS OF CHANGE	2.11	DoC GLOBALISATION AND RISE OF NEW PLAYERS: IMPORTANCE	%
2	DRIVERS OF CHANGE	2.12	DoC GLOBALISATION AND RISE OF NEW PLAYERS: URGENCY	%
2	DRIVERS OF CHANGE	2.13	DRIVERS OF CHANGE PRIORITY INDEX	N°
3	SKILLS	3.1	SKILL INDEX	N°
3	SKILLS	3.2	SKILL MATRIX EQF / GRADUATES	MATRIX
4	JOB ROLES	4.1	JOB ROLE INDEX	N°
5	VET PROVISION MECHANISMS	5.1	TRAINING APPROACH	%
5	VET PROVISION MECHANISMS	5.6	APPRENTICESHIP EQF LEVELS	%
6	RECOGNITION AND QUALIFICATION	6.1	SKILLS RECOGNITION AND QUALIFICATION FRAMEWORKS	%
7	RECRUITMENT AND ATTRACTIVENESS	7.3	METHODS	%

Table 2: KPI groups

All the questions and relative KPIs (where available) have been analysed by overall value and filtered by the following selected categories of stakeholders:

- VET: including VET schools, Colleges and Universities
- INSTITUTE: including Research institute and Accreditation centre/qualification body
- PRIVATE: all private companies (excluding other categories above)
- UMBRELLA ORGANISATION: association of institutions, who work together formally to coordinate activities or pool resources

The result of this activity is shown in Table 3.

#	CATEGORY	KPI	INDICATOR TITLE	OVER ALL	VET	INSTITUTE	PRIVATE	UMBRELLA ORGANISATION
1	SAMPLE CHARACTERISATION	1.1	N° OF RESPONDENTS	X				
1	SAMPLE CHARACTERISATION	1.2	CATEGORY	X				
1	SAMPLE CHARACTERISATION	1.3	TYPE OF ORGANISATION	X				
1	SAMPLE CHARACTERISATION	1.4	RESPONDENTS PER COUNTRY	X	X	X	X	X
1	SAMPLE CHARACTERISATION	1.5	RESPONDENTS JOB TITLE	X				
1	SAMPLE CHARACTERISATION	1.6	COURSES PROVIDED	X				

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#	CATEGORY	KPI	INDICATOR TITLE	OVER ALL	VET	INSTITUTE	PRIVATE	UMBRELLA ORGANISATION
1	SAMPLE CHARACTERISATION	1.7	LANGUAGES PROVIDED	X				
1	SAMPLE CHARACTERISATION	1.8	LEARNERS ATTEND	X				
1	SAMPLE CHARACTERISATION	1.9	EQF OFFERED	X				
2	DRIVERS OF CHANGE	2.1	IMPORTANCE OF DRIVERS OF CHANGE GROUPS	X	X	X	X	X
2	DRIVERS OF CHANGE	2.2	URGENCY OF DRIVERS OF CHANGE GROUPS	X	X	X	X	X
2	DRIVERS OF CHANGE	2.3	DoC NEW TECHNOLOGIES AND BUSINESS MODELS: IMPORTANCE	X	X	X	X	X
2	DRIVERS OF CHANGE	2.4	DoC NEW TECHNOLOGIES AND BUSINESS MODELS: URGENCY	X	X	X	X	X
2	DRIVERS OF CHANGE	2.5	DoC CLIMATE GOALS, ENVIRONMENTAL […]: IMPORTANCE	X	X	X	X	X
2	DRIVERS OF CHANGE	2.6	DoC CLIMATE GOALS, ENVIRONMENTAL […]: URGENCY	X	X	X	X	X
2	DRIVERS OF CHANGE	2.7	DoC SOCIETAL CHANGES AND […]: IMPORTANCE	X	X	X	X	X
2	DRIVERS OF CHANGE	2.8	DoC SOCIETAL CHANGES AND […]: URGENCY	X	X	X	X	X
2	DRIVERS OF CHANGE	2.9	DoC STRUCTURAL CHANGES: IMPORTANCE	X	X	X	X	X
2	DRIVERS OF CHANGE	2.10	DoC STRUCTURAL CHANGES: URGENCY	X	X	X	X	X
2	DRIVERS OF CHANGE	2.11	DoC GLOBALISATION AND RISE OF NEW PLAYERS: IMPORTANCE	X	X	X	X	X
2	DRIVERS OF CHANGE	2.12	DoC GLOBALISATION AND RISE OF NEW PLAYERS: URGENCY	X	X	X	X	X
2	DRIVERS OF CHANGE	2.13	DRIVERS OF CHANGE PRIORITY INDEX	X	X	X	X	X
3	SKILLS	3.1	SKILL OFFER INDEX	X	X	X	X	X
3	SKILLS	3.2	SKILL MATRIX EQF / GRADUATES	X	X	X	X	X
5	TRAINING PROVISION MECHANISMS	5.1	TRAINING APPROACH	X	X	X	X	X
5	VET PROVISION MECHANISMS	5.6	APPRENTICESHIP EQF LEVELS	X	X	X	X	X

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#	CATEGORY	KPI	INDICATOR TITLE	OVER ALL	VET	INSTITUTE	PRIVATE	UMBRELLA ORGANISATION
7	RECOGNITION AND QUALIFICATION	6.1	SKILLS RECOGNITION AND QUALIFICATION FRAMEWORKS	X	X	X	X	X
8	RECRUITMENT AND ATTRACTIVENESS	7.3	METHODS	X	X	X	X	X

Table 3: Detailed KPI filters

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3 MAIN GOALS AND STRATEGY ADOPTED

The Main Goals and Strategy section outlines the overall research and intelligence work programme adopted throughout the DRIVES project, as context for consultation with VET stakeholders.

Following the former survey focusing on industry demand, the DRIVES project implemented a second survey in the second semester of 2019, in order to gather relevant intelligence and underpin the development of a strategic roadmap for the sector.

The main aim of the this "offer" survey is to connect with the DRIVES project partners in order to gather crucial input for the automotive sector's VET offer program and to focus on the following tasks:

- To map and assess the current VET offer based on the current demand of the European automotive sector

- In the context of an understanding of current demand requirements, identify gaps in and improvements required to curricula and programmes in order to meet industry requirements

- To identify and recommend potential improvements to existing VET curricula and programmes, as well as propose and endorse new training programmes that should be developed in the future

- To develop and test a universal methodology for assessment of future developments in provision

- To closely monitor and report on demand developments in the industry on an annual basis that imply the need for enhanced provision

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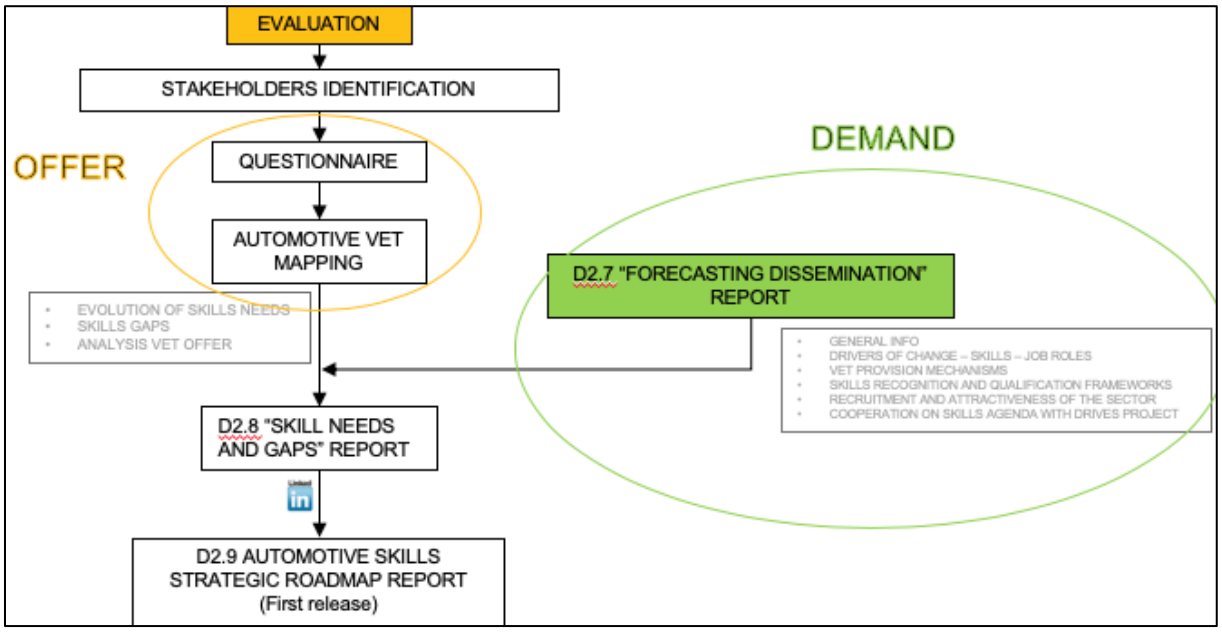

Figure 1: DRIVES project Work Package 2 Demand and Offer surveys structure and linkages

Figure 1 sets out a structured summary of key actions and activities undertaken through the "demand" and "offer" surveys and respective linkages.

The intelligence that has been assembled from external stakeholders as part of the former demand survey of the automotive sector provides an essential basis for determining skills and proficiencies critical for progress and development in the sector.

The second 'offer' survey has built on the results of the former 'demand' survey in order to assess the adequacy of the current VET offer and identify amendments to existing or new training programmes in order to meet current and future demand requirements.

In order to stimulate and encourage a high response rate for the survey, it was designed taking into account the following considerations:

- INTERACTIVITY: The survey's sleek and modern design has been constructed in an interactive manner to allow for clear understanding and ease of completion by all participating third-parties of the DRIVES project

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- ONLINE ACCESSIBILITY: The survey has been electronically connected to the network, to allow for flexibility in its completion though the most popular website browsers currently operating in the European area.
- PAUSABILITY: Due to the length of the survey, estimated to require approximately 20 to 25 minutes for completion, a function allowing the respondent to skip sections has been included, together with the option of saving all input for completion upon a later occasion.
- CLEAR GUIDELINES: In order to facilitate a better understanding of the survey, ensure accuracy from respondents and to enable further analysis, a dedicated webinar was conducted. This allowed direct communication with participating third parties and provided the opportunity for a detailed presentation and commentary to ensure accurate input throughout all sections of the survey.

In practice, the following stakeholder groups were encouraged to participate in the DRIVES project's "offer" questionnaire and report on provision, ranging from EQF3 to EQF8 levels, as follows:

- VET schools
- Colleges
- Universities
- Research institutes as well as research centres
- Accreditation, certification or qualification bodies
- Private companies (excluding other categories above) and involved into EQF3 to EQF8 "activities"
- Umbrella organisations

The comprehensive list of stakeholders targeted in relation to the "demand" survey, together with the VET "offer" survey is outlined in the **Figure 2** below.

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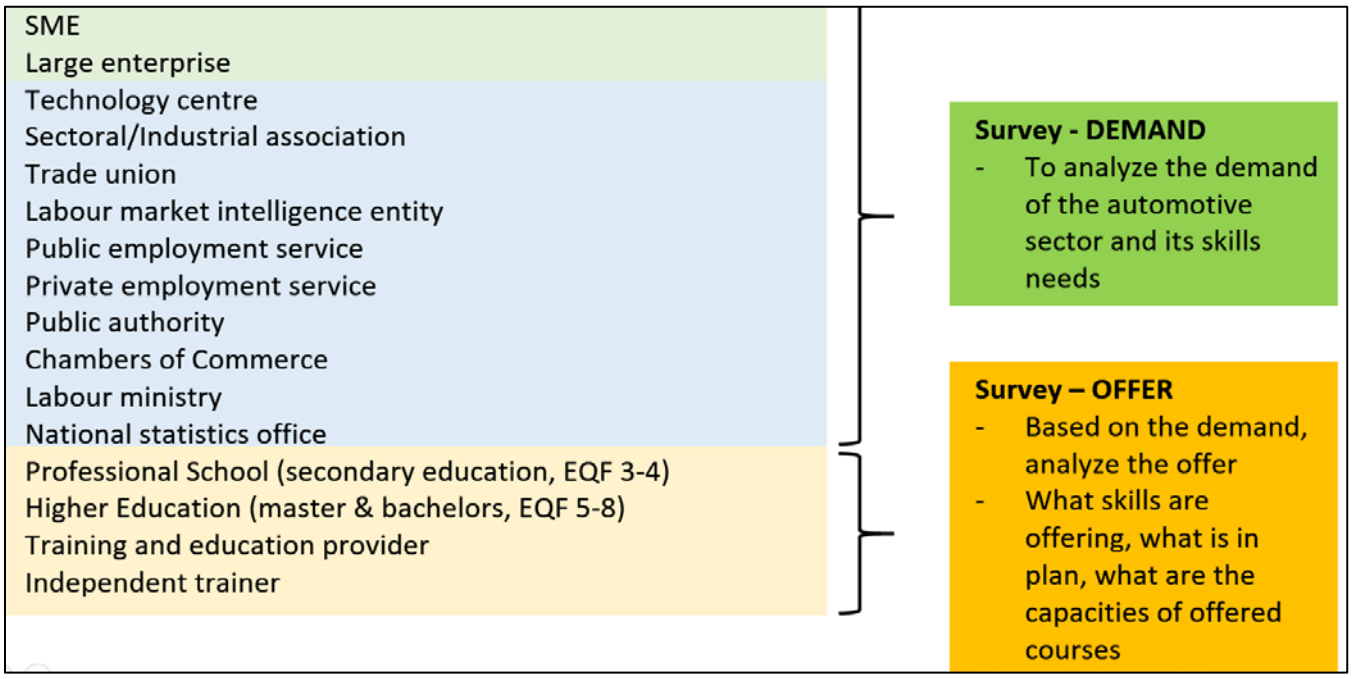

Figure 2 List of stakeholders engaged in the Work Package 2 questionnaires

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4 CURRENT VET IN EUROPE

This Chapter offer a view of the European VET system in 7 countries, based on a des-research activity made by DRIVES partners. This activity has been done to increase the accuracy of the Offer survey.
The research was conducted at all levels of VET and focused on the description of the whole qualifications framework at EQF level 1-8 in line with the research focus and the objectives of the report.

4.1 INTRODUCTION TO VET

Vocational Education and Training (VET) is a key element of lifelong learning systems that equip citizens with the necessary knowledge, skills and competences in certain professions and in the labour market. Over the past decade there has been an important shift in focus in terms of the development of the European policy framework for VET, which has had to adapt to new and emerging needs, with a shift in priority from the formulation of policies to their implementation. These changes have forced the European Union to adapt existing policy frameworks and develop new frameworks in order to support European cooperation in the field of VET.
VET needs to respond to the needs of the economy, but also provide students with important skills for personal development and active citizenship. VET can also boost performance, competitiveness and research and innovation of companies, and is an essential element for the success of social and employment policies.
European education and vocational training systems rely on a well-developed network of VET providers. These networks are effective due to the participation of social partners, such as employers and unions, together with different organizations, such as chambers, local governments and councils.
According to a December 2018 study of the Vocational Training Advisory Committee[3], Vocational Education and Training is one of two key pathways for young people to enter the labour market. On average 50 % of young Europeans participate in initial VET (at upper secondary level). However, the EU average masks significant differences, ranging from participation rates of 73 % to less than 15 %.
Around one third of young adults enter the labour market directly after completing an upper-secondary VET activity; another 20% continue into tertiary education. Following a VET pathway can improve labour market prospects: at a time when 40% of European employers cannot find people with

[3] *"Opinion on "THE FUTURE OF VOCATIONAL EDUCATION AND TRAINING POST 2020" 3 December 2018*

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the right skills to fill their vacancies, 80% of VET graduates find their first long-term job within six months of finishing their studies.

Furthermore, evidence shows that 60-70% of apprentices move directly into a job following their apprenticeship, and in some cases, this increases to 90 %. The VET pathway also provides for a competitive salary – young people with a vocational qualification earn 25% more than those with only a low level of education and 17% more than those with a medium level general education qualification. In some countries the salaries of those with a VET qualification are even comparable to the salaries of those who have a university degree. VET also plays a key role in the continuing professional development of adults. The percentage of EU-28 companies that had provided any type of continuing vocational training in the previous year is increasing systematically (from 49.7% in 2005 to 60% in 2015) with the biggest increase registered among small companies (~11pp).

In non-vocational training the opposite trend (EU-28) can be observed. In 2005, 50% of companies had offered non-vocational training in the previous year and in 2015 only 39.9% - a decrease of 10.1pp. The biggest decrease was registered among small companies (~11pp). Regarding job-related non formal training, the latest data indicates that, on average, 27.5% of adults (25-64) participated in this form of learning in the 12-month period prior to the survey. In the case of employed people in companies in 2015, 40.8% of them participated in job related training.

For the European Union, the main priorities for Vocational Training 2015-2020 refer to European cooperation in education and Vocational Training (VET) being reinforced by the Bruges Communiqué and the *Riga Conclusions*[4]. These priorities are set out below*:*

With a view to developing high quality and labour market relevant vocational skills and qualifications, based on the learning outcomes approach:

1. Promote work-based learning in all its forms, with special attention to apprenticeships, by involving social partners, companies, chambers and VET providers, as well as by stimulating innovation and entrepreneurship
2. Further develop quality assurance mechanisms in VET in line with the EQAVET recommendation and, as part of quality assurance systems, establish continuous information and feedback loops in I-VET and C-VET systems based on learning outcomes.

For people's informed choice of pathways and long-term employability and adaptability to evolving skills needs:

[4] *On a new set of medium term deliverables in the field of VET for the period 2015-2020 as a result of the short-term deliverables defined in the 2010 Bruges Communiqué.*

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3. Enhance access to VET and qualifications for all through more flexible and permeable systems, notably by offering efficient and integrated guidance services and making available validation of non-formal and informal learning.
4. Further strengthen key competences in VET curricula and provide more effective opportunities to acquire or develop those skills through I-VET and C-VET.

In support of successful implementation of reforms and to raise the overall quality and efficiency of VET:

5. Introduce systematic approaches to, and opportunities for, initial and continuous professional development of VET teachers, trainers and mentors in both school and work-based settings.

The EU institutions, the Member States, the candidate countries, the countries of the European Economic Area, the social partners and the European VET providers have agreed on a series of actions for the period 2015-2020:

- To promote work-based learning (WBL) in all its modalities, with special emphasis on the training of apprentices, through the participation of social partners, companies, chambers and VET centres, and the stimulation of innovation and entrepreneurship.
- To continue to develop quality assurance mechanisms in VET in line with the recommendation on the establishment of a European Reference Framework for Quality Assurance in Vocational Education and Training (EQAVET), and establish continuous information and feedback loops in IVET and Lifelong Learning (LLL) systems based on learning outcomes.
- To improve access to VET through more flexible and permeable systems, in particular through the provision of integrated and efficient guidance services and the validation of non-formal and informal learning.
- To strengthen key competencies in VET curricula and offer more effective opportunities to acquire or develop those capacities through the IVET and the LLL.
- To introduce systematic approaches and opportunities for initial and continuous professional development of VET teachers, trainers and tutors, both in an educational context and in the workplace.

The Vocational Training Advisory Committee approved a paper on the future of VET that will contribute to the political work of the Commission beyond 2020.

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The European level initiatives to support national VET modernization[5] should ensure continuity with current political commitments within the Bruges Communiqué and Riga Conclusions and relevant Council Recommendations and Decisions:

- Decision (EU) 2018/646 of the European Parliament and of the Council of 18 April 2018 on a common framework for the provision of better services for skills and qualifications (Europass),
- Council Recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning,
- Council Recommendation of 22 May 2018 on Key Competences for Lifelong Learning,
- Recommendation of the European Parliament and of the Council of 18 June 2009 on the establishment of a European Quality Assurance Reference Framework for Vocational Education and Training (EQAVET),
- Recommendation of the European Parliament and of the Council of 18 June 2009 on the establishment of a European Credit System for Vocational Education and Training (ECVET),
- Council Recommendation of 20 December 2012 on the validation of non-formal and informal learning,
- Council Recommendation of 19 December 2016 on Upskilling Pathways: New Opportunities for Adults,
- Council Recommendation of 20 November 2017 on tracking graduates, and
- Council Recommendation of 15 March 2018 on a European Framework for Quality and Effective Apprenticeships."

The work of the Commission on VET matters is supported by two agencies:

- The European Centre for the Development of Vocational Training (CEDEFOP) contributes to developing European VET policies and assists in the application of these policies through research, analysis and information on VET systems, policies and practices and on the supply and demand of capacities in the EU.
- The European Training Foundation (ETF) contributes to the development of professional skills and competencies in the context of the EU's external relations policy.

In 2017, CEDEFOP carried out an investigation to analyse the opinions that European citizens have about VET[6]. This study was carried out over 10 months and included collaboration of 820 professionals

[5] *THE FUTURE OF VOCATIONAL EDUCATION AND TRAINING POST 2020, 3 December 2018, The Advisory Committee on Vocational Training*
[6] *https://www.cedefop.europa.eu/files/8118_en.pdf*

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from 6 different countries of the European Union who interviewed more than 35,546 people from 30 different countries.

The results of this study will provide an essential basis for defining the guidelines that will set the course of VET over the next decade. It will also allow identification of possible stereotypes and misconceptions that influence VET design, as well as help in understanding the challenges and limitations of VET which are essential for effective development of innovative policies that will allow VET to become the driver of change in improving socioeconomic conditions across Europe.

A study carried out by CEDEFOP in 2018[7] shows how the different agents involved in the process of VET – VET providers, universities, etc. - have to work.

- **Skills Development** represents the training and education activities of each country and the immediate outputs of that system in terms of the skills developed and attained. Sub-pillars are included to distinguish compulsory education, and other education and training (lifelong learning activities). The basic education sub-pillar comprises 3 indicators to measure quality, participation and achievement in compulsory education: pre-primary pupil-to-teacher ratio; share of population aged 15-64 with at least upper secondary education; and reading, maths & science scores (aged 15). The third indicator corresponds to one of the EU education and training targets for 2020, namely to reduce the underachievement in reading, maths and science below 15%. The training and other education sub-pillar comprises 3 indicators to measure participation and achievement in lifelong learning activities: participation in recent training; participation in VET; and achievement of high level computer skills. The first indicator corresponds to one of the EU education and training targets for 2020, namely to reach 15% adult participation in learning. Detailed information on the definitions and the background of these indicators can be found in the Technical Report.

European Skills Index, CEDEFOP 2018[8]

- **Skills Activation** includes indicators of the transition from education to work, together with labour market activity rates for different groups of the population, to identify those which have a greater or lesser representation in the labour market. The transition to work sub-pillar comprises 2 indicators to measure transition from education to employment: early leavers from training; and recent graduates in employment. The first indicator corresponds to one of

[7] *https://www.cedefop.europa.eu/es/publications-and-resources/data-visualisations/european-skills-index*
[8] *https://www.cedefop.europa.eu/en/publications-and-resources/data-isualisations/european-skills-index/skills-development*

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the EU education and training targets for 2020, namely to reduce the early leavers from education and training below 10%. The second indicator corresponds to another of the EU education and training targets for 2020, namely to reach the employment rate of recent graduates of 82%. The labour market participation sub-pillar comprises 2 indicators to measure activity rates of different groups of the population: activity rate of the 'core' working population (25-54 year olds); and the youth activity rate (20-24 year olds). Detailed information on the definitions and the background of these indicators can be found in the Technical Report.

- **Skills Matching** represents the degree of successful utilisation of skills in terms of the extent to which skills are effectively matched in the labour market. This can be observed in the form of labour market mismatches which include unemployment, skills shortages, surpluses or underutilisation of skills in the labour market. Sub-pillars are included to distinguish skills under-utilisation and skills mismatches.
- The **skills utilisation** sub-pillar comprises 2 indicators to measure different aspects of skills under-utilisation: long-term unemployment; and the underemployment of part-time workers (those who declare that they work part-time because they are unable to find full-time work). The **skills mismatch** sub-pillar comprises 3 indicators to measure different aspects of surpluses or underutilisation of skills in the labour market: higher education mismatches (those with higher education that have a job that does not require it); low wage earners (tertiary graduates that are low wage earners); and qualification mismatches (the extent to which each employee's education attainment level matches the modal education attainment level for each occupation in each industry). Detailed information on the definitions and the background of these indicators can be found in the Technical Report.

To complete all this, CEDEFOP published a tool called the European Skills Index[9] in 2018 in order to measure the performance of European countries in the development and activation of the main skills involved in Vocational Training. This is an online tool that allows you to visualise skill classifications in different EU countries and measure the distance a country is from the European average and also the ideal performance in relation to different skills and competencies.

All these competences and skills are conditioned by a series of factors that CEDEFOP once again includes in its document 'Changing nature and role of vocational education and training in Europe',

[9] *https://www.cedefop.europa.eu/files/8135_en.pdf*

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Working paper 2[10], where a number of external factors that will have implications for any VET system are identified. These include:

- demographic change (including migration);
- the business cycle;
- globalisation / offshoring;
- technical change / digitisation / robotics;
- organisational change within workplaces and within sectors (including sectoral restructuring, etc.);
- public policy (e.g. systems of social protection that use VET as part of their efforts to combat social exclusion, macroeconomic policy, etc.).

In many respects, the above can be considered to be long-term structural shifts in the economy that give rise to a number of demands on VET systems. It is expected that these factors will result in changes being made to various elements of the VET system, including:

- the means used to anticipate emerging skill needs;
- curriculum and course design;
- the means used to deliver skills (including both teaching / learning methodologies,
- the emphasis placed on work based learning;
- funding levels and mechanisms;
- the measures used to direct or nudge behaviour in relation to VET (including the use of subsidies, incentives, and markets);
- the means used to raise participation levels (especially in particular types of courses or fields of study where demand is in danger of not being met; the role of labour market information systems and careers guidance, etc.).

Alongside the longer-term structural shifts there are shorter-term, frictional factors that affect VET provision and VET policy. The most obvious is the business cycle and the effect it has upon the demand for skills and labour. It is readily apparent that the sovereign debt crisis at the end of the 2000s continues to cast a shadow over the EU's economy, especially with respect to the relatively high levels of youth unemployment that still prevail in many countries.

[10] https://www.cedefop.europa.eu/files/working_paper_2_-_external_factors_influencing_vet_-_draft_syntehsis_report.pdf

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4.2 VET DELIVERED AND COUNTRIES CLASSIFICATION

Based on the share of VET delivered in the workplace versus vocational schools[11] it is possible to develop a countries' classification:

- Type 1. These are dual systems of apprenticeship. Apprenticeship systems are closely integrated with labour market institutions and the world of work, and this has important effects on the labour market value of the qualifications they offer and the consequent incentives this provides for apprentices. Examples include Denmark, Germany, and Switzerland.
- Type 2. These are systems with participation distributed relatively equally between school based general education and employment-based dual systems of apprenticeship. Austria and the Netherlands belong to this type.
- Type 3. Hungary represents an exceptional type because the percentage of IVET students is low, but the percentage of work-based students is very high.
- Type 4. The United Kingdom is classified as a separate type because the percentage of IVET students as well as work-based students, are at the medium level in this country.
- Type 5. These are predominantly school-based systems with general academic and vocational provision in different types of dedicated upper-secondary institutions and with apprenticeships representing separate but residual systems. Most Central and Eastern European (CEE) countries (the Czech Republic, Slovakia, Croatia, Romania, Bulgaria, Poland and Slovenia) as well as Finland, Luxembourg, Belgium and Italy belong to this type.
- Type 6. These are 'non-vocational' countries with the limited vocational systems. This is the modal type in most southern European countries (Spain, Portugal, Greece, Cyprus) and other western countries influenced historically by the French education system (France) but also in Baltic countries (Estonia, Latvia and Lithuania) and in Sweden.

Having a VET system that is attractive to both employers and learners is important. If VET is not attractive to employers and learners, then it is unlikely to satisfy its societal and economic objectives. VET has a need to meet both current and future skill needs of both employers and individuals (i.e. learners). One of the major shifts in the early 1990s was the move to a competence-based model of VET provision. A competence based approach allied to professions/occupations has the potential to create a tension between the provision of training, that is related to one particular profession and

[11] *Source: Changing Nature of VET Work Assignment 4*

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essentially makes the trainee/apprentice ready to work in that profession, versus providing training that is less occupation specific, but provides increased opportunities for mobility. The latter approach has a stronger focus on transversal skills and career adaptability (the ability to apply your skills, knowledge and understanding in a variety of contexts). Such an approach also provides a degree of protection from future economic change.

A potential outcome of allowing employers to have a central role in the design of standards is that it could lead to a proliferation of fairly narrow occupational standards. A concomitant risk would then be that these standards might not provide the breadth of learning that will afford a degree of protection to the learner and / or the employer from the forces that lead to skills obsolescence (for the learner) and skills shortages (for the employer). Some employers in standard setting bodies may recognise the importance of the development of transferable skills, but they may also be concerned that it may increase the likelihood that too many learners choose another career direction rather than staying in the occupation for which they initially trained. One of the attractions to employers of providing apprenticeships relates to the degree of influence they have over the training delivered. Although there are curricula to be followed, whilst the apprentice is in the workplace the employer has a degree of flexibility in deciding the way in which skills are learnt and used in practice. This might be regarded as one of the essential ingredients that will ensure an apprenticeship is tightly tied to the demand for skills in the labour market. This then relates to a wider set of issues about the extent to which the social partners – particularly employers - are engaged in design and delivery of VET.

With respect to this issue, there are pressures in different directions. In England employers have been granted increased influence over apprenticeship standards and the risk here is that the occupational standards developed are both numerous and rather narrow.

At the same time, outside of apprenticeships, amongst the vocational qualifications that have many more participants, the government is seeking to simplify the system into a small number of 'technical education routes' aimed at 16-18 year olds as attractive alternatives to the long-established general 'Advanced' level qualifications. Indeed, the general European trend, as highlighted by countries such as the Netherlands and Finland is to reduce the number of qualifications. Here there has been a twin-track policy of simplifying the VET system in order to make it more transparent by reducing the number of qualifications on offer and, at the same time, increasing the subject breadth of those that remain to increase their attractiveness to young people. For example, there is sometimes more emphasis on transversal skills. In Finland, the inclusion of optional modules is important to allow the tailoring of broad qualifications to local and sub-sectoral needs.[12]

[12] *CEDEFOP Changing Nature of VET National Studies*

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As noted above, the example of England contrasts with that of other countries - such as the Netherlands, Finland and Norway - where the trend is towards broader standards with a particular emphasis on the inclusion of transversal skills. This has sometimes been achieved with less engagement of employers or social partners more generally.

In the Netherlands there has been a similar trend towards reducing the number of VET qualifications / standards, but at the same time this has involved more flexibility in the delivery of IVET. Whilst there are fewer standards to work towards, there is greater scope for mixing and matching particular modules or elements from other courses by providing for core and optional elements in the delivery of courses. It is apparent that the changes introduced in the Netherlands and Norway has been undertaken with reduced involvement of employers. To some extent, there is more influence vested in vocational training schools and / or regional agencies. So, in effect one is observing a shift from relying upon employers (or their representative organisations) to vocational schools and, in some cases, regional agencies, to determine how the skills system should be flexed to meet local labour market needs. Employers may be represented on 65 regional agencies, but the key point is that the employers are not the main drivers of the system in the way they might have been in the past.

In general, one can begin to see a divergence between:

- providing the employer with increased influence in return for meeting more of the cost of the training delivered by publicly funded IVET systems (e.g. England) with concomitant risk that occupational standards might be narrow; and
- developing broader occupational standards (i.e. more occupations are grouped together) in response to being better able to support occupational mobility and future skill needs (e.g. Norway) and, at the same time, providing a degree of flexibility with respect to the mixing and matching of modules so that the learner can individualise their training to some extent (e.g. the Netherlands). The risk here is that the IVET system proves to be less attractive to employers especially in relation to offering apprenticeships.

Technical change is generally seen as having a positive impact upon employment though it does tend to give rise to new forms of employment and thereby skill needs (Simon, 1965). In general, one needs to consider:

- the long-term impact of technical change on the demand for skills; and
- the contemporary debate about impact of AI, robots, Industry 4.0 and such like on employment and skills.

Some VET systems, such as those in Norway and Germany, are based on clearly defined occupational knowledge and skills. In certain service sectors jobs do not have as well-defined an occupational

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background as those typically found in manufacturing, which makes it difficult to define the jobs which leaners / apprentices are being prepared for.

As a result, in the service industries trade certificates sometimes have low labour market currency and employers have come to prefer training and recruitment strategies disconnected from the formal VET system. In England, where the apprenticeship system has permeated the service sector, there remains an ongoing debate about whether an EQF level 3 qualification in, for instance, retailing is really equivalent to that of, say, a level 3 qualification in electrical engineering. The former will be largely completed by undertaking on-the-job training, whereas the latter will require substantial periods of off-the-job training with completion dependent upon passing an external examination.

The VET system has responded to this challenge of promoting apprenticeships / workplace based training in what one might refer to as non-traditional sectors, by trying to strengthen employer engagement in the development of training standards. In this way the training standard gains currency with employers.

More recently, the debate has tended to regard technical change as having a less benign impact on employment and skills. First there has been the debate about robots and the extent to which they will be a substitute for employment at a rate which outstrips their positive impact on economic growth to create new jobs[13]. The risk here is that robots (essentially an advanced form of automation) reduce the demand for good jobs whilst leaving humans to undertake relatively low skilled, low paid ones[14]. In other words, there is a de-skilling effect. To some extent this is a recasting of the task-based technological change explanation where technological change is seen to have most impact on routine jobs, which do not require their incumbents to respond to outside stimuli. Accordingly, their jobs can be replaced by technology, which automates the tasks they once carried out[15].

This is how in the automotive sector more and more tasks that have traditionally been performed by people are beginning to be replaced by robots. This underlines how it is essential to adapt the skills and competences developed by VET providers in order to respond to changing skill demands of automotive companies.

In recognition that technical change brings about a need for more mobility in the labour market, the VET curriculum is becoming more oriented towards delivering transversal skills. This issue was covered extensively in the previous chapter. It is apparent that transversal skills increasingly encompass digital skills in an effort to prepare people for a fast changing technological environment.

[13] *Brynjolfsson and McAfee, 2012*
[14] *Freeman, 2015*
[15] *Autor et al., 2003*

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The report of the CEDEFOP Communication from the Commission: "Responding to the crisis in the European automotive industry". COM (2009) 104, tries to respond to the needs generated in the automotive sector after the 2008 crisis

This report sets out the following objectives:

1. To support demand in order to assist with remedying the effects of the credit squeeze;
2. To facilitate the adjustment by cushioning the costs associated with restructuring, in particular for workers and upgrade their training
3. To encourage the modernisation of the plants with a view to ensure a sustainable competitiveness of this industry at world level and
4. To assist industry to implement the radical technological change required by the climate change challenge

All these changes have to be taken into account by VET to design training plans that are aligned with the needs of the labour market, as well as the growing technological advances that are occurring every day in the automotive sector.

The following section presents the results of desk-research, undertaken to obtain a view of the VET offer in the EU and provide a solid context for analysis of intelligence gathered through the DRIVES 'offer' survey.

4.3 MAPPING, VISION AND OFFER WHERE AVAILABLE

The section contains a basic introduction to VET systems at the level of selected EU Member States, including initiatives and lifelong learning systems aimed at modernizing the systems and institutions involved in the VET provision process[16]. At the same time, some cases of "good practice" documenting specific solutions in the implementation of VET development policy are listed.

[16] *DRIVES desk-research December 2019-February 2020*

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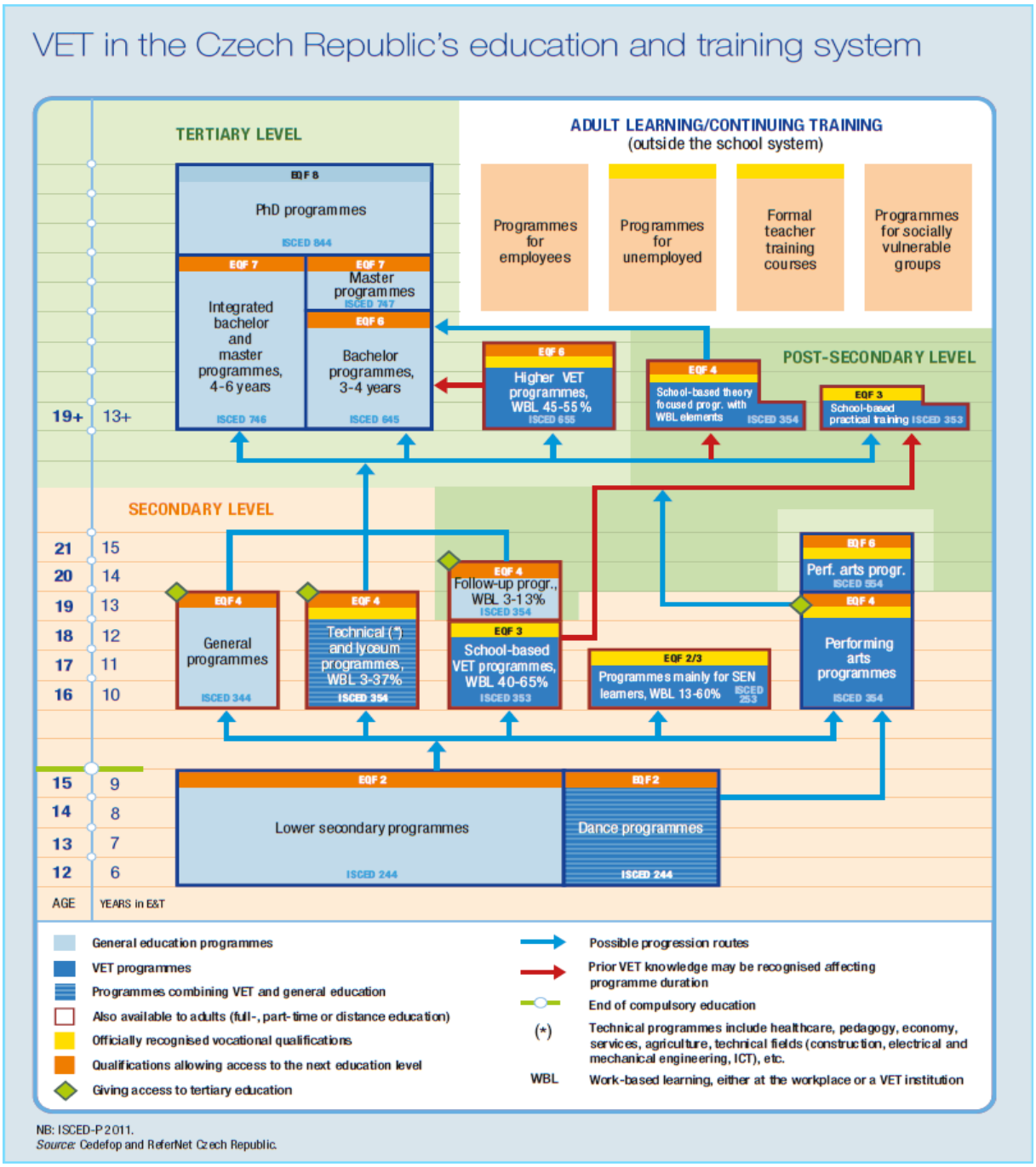
4.3.1 Czech Republic

4.3.1.1. Basic structure of VET



4.3.1.2. Distinctive features of VET

The main body responsible for education (IVET and CVET) at national level is the Ministry of Education, Youth and Sports (Ministerstvo školství, mládeže a tělovýchovy - MŠMT). The key responsibilities of MŠMT include the development of a national education strategy and the setting of priorities in linking

vocational education and training programs with qualifications in the National Qualifications Register (NRK).

1. Primary VET level

- second stage of primary schools / lower grades of multi-year grammar schools - EQF2

2. Secondary VET level

- vocational training and practical training are an integral part of the curriculum. Programs at upper secondary level (EQF 3-4) continue
- three years, vocational certificate (EQF 3) allows graduates to enter the labour market directly or to continue in a two-year follow-up course (EQF 4) and to pass a „maturita“ examination allowing access to higher education;
- four years, the „maturita“ (EQF 4) allows graduates to continue their studies at university or to pursue technical, commercial and similar intermediate professions (e.g. construction engineer, IT system administrator)

3. Post-secondary and tertiary VET levels

- two-year, follow-up programs completed by the "maturita" (EQF 4).
- Those who have already completed secondary education and wish to acquire qualifications in another field may choose 'short programs', which last for one or two years and are particularly suitable for adults.
- The programs of Tertiary professional schools (VOŠ) prepare secondary school graduates (with a „maturita“ examination) for qualified performance of demanding professional activities. The study lasts three to three and a half years and is completed with „absolutorium“ (EQF 6). These programs provide practical tertiary education and are closely linked to employers' skills needs.

4. University programs

- Bachelor's and Master's programs (4-6 years, EQF7), then it is possible to complete doctoral programs (EQF 8)

5. Adult education outside the school system

- retraining courses incl. examinations and gaining professional qualifications according to the National Qualifications Framework, using mainly IATF standards

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4.3.1.3.Challenges and policy responses

With the expiration of the „Strategy of the Education Policy of the Czech Republic until 2020“, the Ministry of Education is currently preparing a follow-up document “The Strategy of Education Policy until 2030+”[17], which will define the priorities, objectives and measures of the education policy and education system in the future. The Automotive Action Plan on the Future of the Automotive Industry in the Czech Republic - "Czech Automotive Industry 2025”[18] has been prepared, including (among other things) the following measures for the development of VET:

1. *Adaptation of electro technical qualifications for production and service of electric vehicles*

The key stakeholders involved are the Ministry of Labour and Social Affairs (MPSV), Technical Inspection of the Czech Republic, Office for Technical Standardization, Metrology and State Testing, Employers and professional associations and unions

The strategic objective is to ensure a sufficient number of school and workforce graduates with the necessary skills corresponding to the increased demand in connection with the higher share of low-emission vehicles.

Background and Requirements for Implementation of Measures: In connection with the development of electromobility, the need for employees with electro-technical qualifications will increase in car repair shops (condition of 3 years of study followed by at least one-year practice). However, graduates in electrical engineering and related fields (with the exception of Autoelectric and Autotronics) lack education in vehicle construction and repair. One solution is the possibility for automotive graduates to obtain the corresponding simplified electrical education by completing an electrical qualification similar to the German electrical qualification for the specified activities (Elektrofachkraft für festgelegte Tätigkeiten). This qualification will entitle an individual to work independently in the area of development, production and repair of electric vehicles without the need to complete a complete electrical education. The qualification should entitle them to work independently in these fields, but will not entitle them to leadership activities for electrical work on vehicles, or to instruction to acquire additional qualifications. The qualification will be completed within the framework of Decree 50/1978 on professional competence in electrical engineering and created as a new professional qualification in electrical engineering and included in the system of National Qualifications System. Implementation will be carried out by experts from the automotive industry and electrical engineering through sector councils.

[17] http://www.msmt.cz/vzdelavani/skolstvi-v-cr/strategie-2030
[18] https://www.databaze-strategie.cz/cz/mpo/strategie/akcni-plan-o-budoucnosti-automobiloveho-prumyslu-v-cr-cesky-automobilovy-prumysl-2025

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2. *Analysis and revision of the secondary vocational education offer in response to the emergence of new trends in the automotive industry*

Researchers are MŠMT, vocational secondary schools, National Institute for Education, Czech National Coalition for Digital Jobs, Employers, and Sectoral Councils

Contents: Analysis of Framework Educational Programs (FEPs) and Updates of School Educational Programs (SEPs), following the revision of FEPs from the 2020/2021 school year.

Background and requirements for implementation of the measure and objectives of the measure: Due to developments in the automotive industry, vocational training requires systemic preparation for the onset of e-mobility and low-emission mobility, digitization and autonomous management. The aim is to define the requirements for revision of the content and scope of Framework Educational Programs and to include this issue in the vocational educational component of the fields involving apprenticeship certificates or school-leaving examinations. In connection with the automotive industry, these are primarily education courses providing secondary education with an apprenticeship certificate of category H: Mechanic repairing motor vehicles, Autoelectrician, Electro-mechanic for equipment and instruments, and for fields of education providing secondary education with „maturita“ categories M and L: , Autotronics, Motor vehicle diagnostics, Vehicle construction and design.

3. *Strengthening and creating new competences for graduates and study programs of universities and establishing platforms for cooperation with companies, public administration and schools*

Involved partners are MŠMT, Universities, National Accreditation Office for Higher Education, Czech National Coalition for Digital Jobs, Employers, and Professional Associations

Contents: Analysis of current evaluation procedures for granting accreditation to study programs and subsequent dialogue between university representatives and employers and formulation of accreditation requirements for new study programs relevant to the automotive industry. Application of these requirements to modernization (for schools with institutional accreditation) or to the emergence of new study programs from the academic year 2019/2020.

Background and requirements for the implementation of the measure and objectives of the measure: The aim is to ensure the competences of graduates and study programs of universities correspond to new trends and needs of the automotive industry: e.g. e-mobility technology, unconventional drives, car physics machine vs. machine interface user, safety and security systems, digitization, intelligent sensors, V2V and V2I communication protocols, electronic communications networks, etc. In relation

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to new mobility trends, it is necessary to focus on strengthening / expanding / emerging new related higher education study programs in accordance with research and development programs.

Description of the implemented measure and benefits and impacts of the implementation of the measure: On the basis of current trends in the automotive industry and the results of a survey to employ university graduates in the labour market, the objective will be to determine the competences of graduates for the automotive industry and revise university study programs. Simultaneously, analysis of the priorities of companies based on the results of the survey will be undertaken in order to formulate, together with the representatives of universities, the requirements for accreditation of new study programs according to the current needs of the automotive industry.

Forecasting qualification needs

At the national level of the Czech Republic, several initiatives are currently underway at the research level aimed at developing methods and tools for early identification of skills needed. Projects are awarded by the Ministry of Labour and Social Affairs (Ministerstvo práce a sociálních věcí - MPSV) and the Ministry of Education, Youth and Sports (MŠMT) or social partners.

At a regional level, there are twenty-nine sectoral councils (organized by employers and professional associations and established gradually since 2005), which monitor the coverage of their skills sectors, identify new skills trends and propose new skills. The Mechanical Engineering Council of the automotive industry is responsible for the areas covered by NACE codes C 25, 28, 29, 32, 33, G 45.2

The KOMPAS project[19], which aims to create a system to anticipate labour market needs and to link central and regional approaches, is also being implemented. The key partners of the MPSV are the National Education Fund (Národní vzdělávací fond - NVF), the Research Institute for Labour and Social Affairs (Výzkumný ústav práce a sociálních věcí - VUPS) and the newly created regional platforms. Within the project, regional partners will create a methodology and a regional structure that will identify the necessary factors influencing changes in the labour market. The created network and methodology will enable the regions to ensure the sustainability of the produced outputs. MoLSA will take over the project outputs, including the forecasting system.

[19] https://www.vupsv.cz/vybrane-projekty/kompas/

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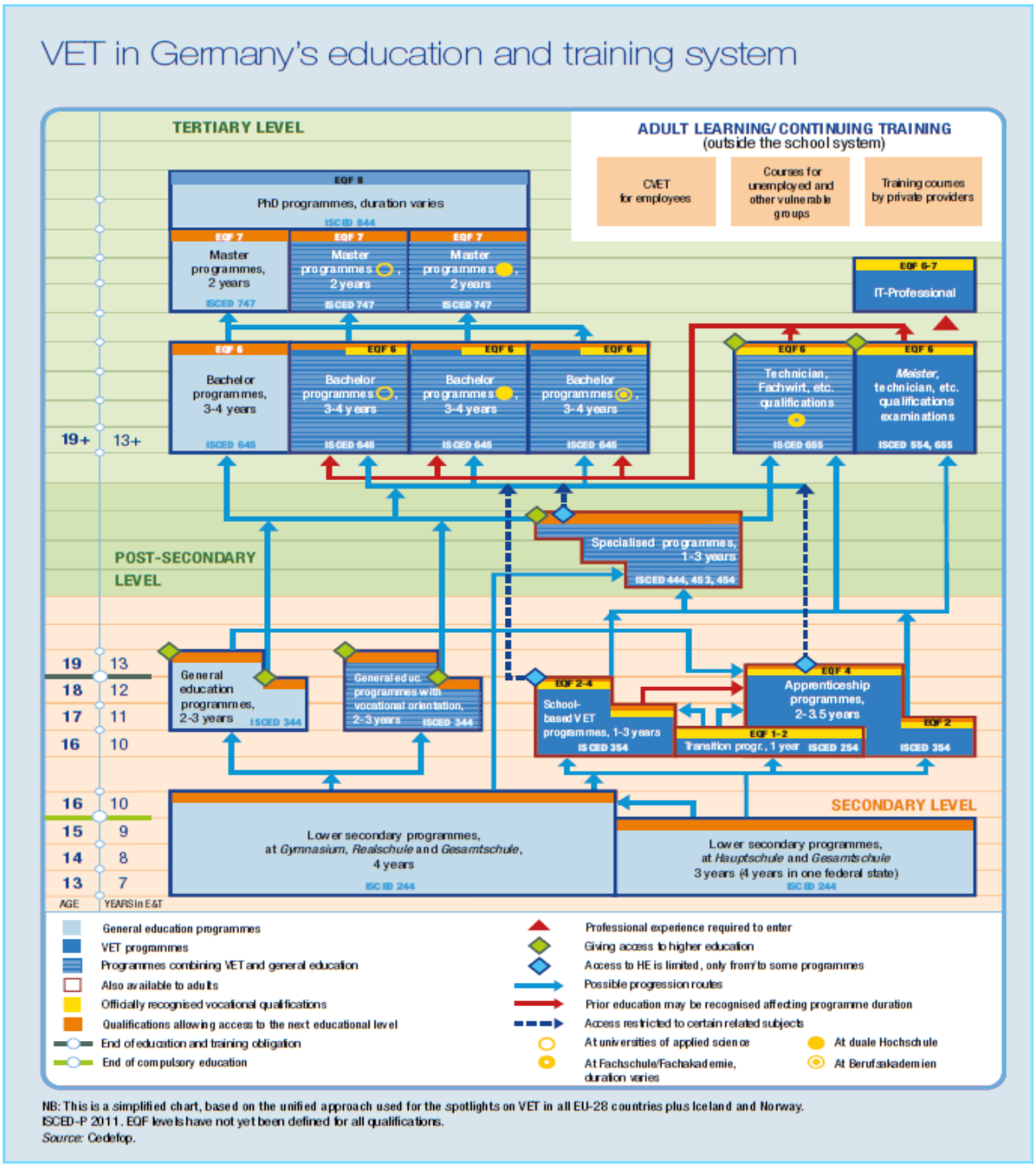
4.3.2 Germany

4.3.2.1. Basic structure of VET



4.3.2.2. Distinctive features of VET

VET in Germany is based on cooperation between the state, companies and social partners. The Federal Ministry of Education and Research (BMBF) are responsible for general VET policy issues and have a coordinating and managerial role. Länder (federal states) are responsible for the school parts

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of vocational education and training and cooperate with representatives of employers and employees. The apprenticeship program (dual system) at upper secondary level (EQF level 4) is the main pillar of VET. It usually lasts for three years and combines two learning sites, a company and a vocational school (the share of work-based learning is around 70%)[17]. To participate in the dual VET program, an apprenticeship contract must be concluded and businesses bear the cost of corporate training and pay students wages. Those who have successfully completed training are qualified to work as skilled workers. Progression is possible through various VET programs offered at post-secondary and tertiary levels.

In parallel to apprenticeships, there are higher education VET programs (levels 2 to 4 EQF) that differ in access, length, type and usually lead to general qualifications for admission to higher education.

At post-secondary level, specialized programs provide deeper professional knowledge (duration of one to three years). This leads to entry qualifications for universities of applied sciences. At tertiary level, vocationally qualified candidates without a university entry qualification have access to Advanced Vocational Training (AVT) leading to an EQF level 6 qualification. AVT is the core of the VET system. It provides the right to self-employment, train as an apprentice and enter higher education. It also facilitates the acquisition of middle management qualifications in companies. Courses or schools (master craft schools) offer courses to prepare for these advanced VET qualifications. In general, access to appropriate assessment requires several years of practice in a related profession. The idea of dual practice-oriented learning is gaining importance in higher education (at levels 6-7 of the EQF). Dual study programs provide a blend of vocational and academic education offered by universities of applied sciences (lasting three to four years) and other universities (Berufsakademien, duale Hochschule) leading to dual education (vocational qualifications and undergraduate studies). Companies participating in the programs offered by the academy bear the costs of company-based training and pay pupils wages. Further improvement plays an increasingly important role and is characterized by a wide range of providers (education market) and a relatively low level of government regulation. German vocational education is a dual-system model and, thanks to successful apprenticeships, leads to high-quality vocational qualifications. Apprenticeships allow a smooth transition to employment and half of secondary school graduates choose a vocational training program; 70% of them participate in apprenticeships. An increasing share of university entry qualifications highlights the attractiveness of apprenticeship training. Dual tertiary level programs and advanced vocational education support the acquisition of upper and upper management qualifications in companies.

The success of dual education programs is ensured by national standards and training regulations (curricula for both business and school components). Companies provide training in accordance with

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training regulations developed by four stakeholders (federal and state governments, companies and trade unions). These regulations allow for flexibility in agreeing company training plans with apprentices. Vocational school learning is based on a framework curriculum that is compliant with education regulations and developed for each recognized profession.

Regular revisions of the training regulations ensure that the pace of rapid technological and organizational changes is maintained. Another peculiarity of the German VET system is its approach to the acquisition of vocational competences, the so-called 'Competence in Vocational Training': a holistic and integrated approach to acquiring competences in VET compared to the acquisition of isolated access-based skills and competences and learning outcomes for the European Qualifications Framework (EQF).

4.3.2.3. Challenges and policy responses

The German VET education system in the automotive industry reflects the impact of technological change on employment structures. In Germany, where 10 million electric vehicles are expected to be operational by 2030, some 240 000 jobs will be at risk in an extreme scenario (depending on battery cell imports)[20]. The reduction in the number of jobs will mainly concern the area of vehicle construction and power plant production.

The structure of continuing vocational training and qualifications in the mobility sector must be adapted to the challenges of technological change. The basis for further education and qualification campaigns in the mobility sector will therefore be the pillar concept, which consists of a central framework for all stakeholders in further education and the implementation of qualifications within the Regional Competence Centres. The goal is to provide companies and their employees with the tools to successfully pass the upcoming changes in work profile requirements. An analysis of successful staff planning and development measures from different companies ("Best Practice"[20]) shows that *training providers should reflect:*

1. the results of strategic personnel planning to identify and cover future staff surpluses or shortcomings, both quantitative and qualitative in nature. Companies must be supported by tools to anticipate and plan future personnel requirements in order to be able to separately identify future personnel needs;
2. target images of competences and work profiles based on strategic personnel planning;
3. framework conditions for enabling qualifications arising from competence profiles;

[20,20] *German National platform Zukunft der Mobilität: 1. PRELIMINARY REPORT ON STRATEGIC PERSONNEL PLANNING AND DEVELOPMENT WITHIN THE MOBILITY SECTOR, January 2020*

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4. the need for modular, flexible and personalized training programs that prepare employees for the technology and labour market of the future.

As part of the desk-research undertaken in relation to Germany a number of examples of good practice have been identified:

1. STRATEGIC PLANNING OF PERSONS

COMPANY: Continental AG

GOOD PRACTICE: Strategic personnel planning in relation to the analysis of large data skills

DESCRIPTION:

In 2016 Continental AG introduced Global Strategic Workforce Planning (SWP) to make more strategic decisions based on the targeted use of HR data. From a five-year perspective, the development of the number of employees and requirements is analysed with close involvement of individual business areas, with all analysis mapped. In order to identify specific changes and development needs at an individual skill level, a major data analysis exercise was undertaken separately for software engineers. This has enabled identification of a number of important insights relating to the qualification structure for this target group, which will be particularly important to inform future skill profiles and measures for further targeted development.

2. DEVELOPMENT OF THE OBJECTIVE COMPETENCES AND PROFILES OF WORK

COMPANY: Trumpf, VW, Databay AG, Mauser + Co. GmbH, leifos GmbH

SCIENTIFIC INSTITUTES: International Performance Research Institute, FIR at RWTH Aachen University

GOOD PRACTICE: People - learning in the digitalized world of work

DESCRIPTION:

The LidA - Learning in the Digitalized World of Work project is a research project funded by the Federal Ministry of Education and Research and involves a large partner network. In addition to research partners International Performance Research Institute, University of Ulm and FIR in RWTH Aachen, together with industrial partners VW, Mauser, Databay, leifos and Trumpf project consortium. The associated partners of FVI, IG Metall and the KND service association are also involved. Given the composition of the project team, examples of good practice are of direct relevance to the automotive industry.

The project team discusses how the development of company- and employee-specific skills - as a service close to people - can empower employees to meet the challenges of digital change. An important driver is the changing role of employees in the digital transformation and the resulting need

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for skills change. The aim is to continuously develop future-oriented and employee-specific competences through specific educational pathways. This competence development content should be made available and effectively disseminated through existing open source platforms.

3. DEVELOP THE TARGET PICTURE FOR COMPETENCY AND TASK PROFILES

COMPANY: VW

GOOD PRACTICE: Systematic identification of future competence needs (competence radar)

DESCRIPTION: Seminars on technology and competencies are held to systematically determine which competences and qualifications will be required in the future. Here, workshops are conducted in conjunction with the relevant departments and planning, human resources, works council and Volkswagen Academy to determine which technological changes from the product (component or total vehicle) and new business and production processes affect the corresponding production area, but also indirect areas, and what impact they have on employees.

This happens in the short, medium and long term:

1. Changes over a period of one to two years with regard to the simultaneous launch of the product, the maintenance of the model, changes in production operations and replacement of turnover

2. Changes in three to five years with significant effects due to reorientation of work processes and production structures; Technology leaps through significant changes in eligibility requirements.

3. Strategic changes over a period of> 5 years in relation to production and production processes and new business models that require a massive change in eligibility requirements relating to new work profiles.

4. DESIGNING A FRAMEWORK ORGANIZATION

COMPANY: Continental

GOOD PRACTICE: Continental Institute of Technology and Transformation (CITT)

DESCRIPTION:

By setting up the Continental Institute of Technology and Transformation (CITT), Continental, together with politicians and social partners, aim to ensure the future viability and employability of people.

Whether qualifications, mobility and integration: At CITT, employees can acquire the necessary qualifications for a successful professional future. Initially, the focus will be on the qualification of semi-skilled and unskilled employees: they can be trained as process mechanics and mechatronic engineers through CITT or take a step forward by completing individual modules - the so-called Intermediate Qualifications. Successful completion of advanced training modules leads to IHK certifications and IHK degrees. In the area of qualifications, CITT develops strategy, defines and manages bids, builds the

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necessary structures for implementing further training measures and ensures consistent implementation at all locations.

COMMON GOOD PRACTICE THEMES

The measures and practices outlined under good practice above imply that, in order to help organizations cope with changes in current and future employment linkeed to technological and other transformations of the mobility system, the educational and training offer needs to incorporate aspects of all the above practices. Providing a comprehensive education offering, including personnel planning, competency profiles and framework qualifications created from them, will allow modularised and flexible programs to be offered. This will enable education providers to work across the automotive labour market and share successful learning concepts with other areas, so not limited solely to the automotive sector.

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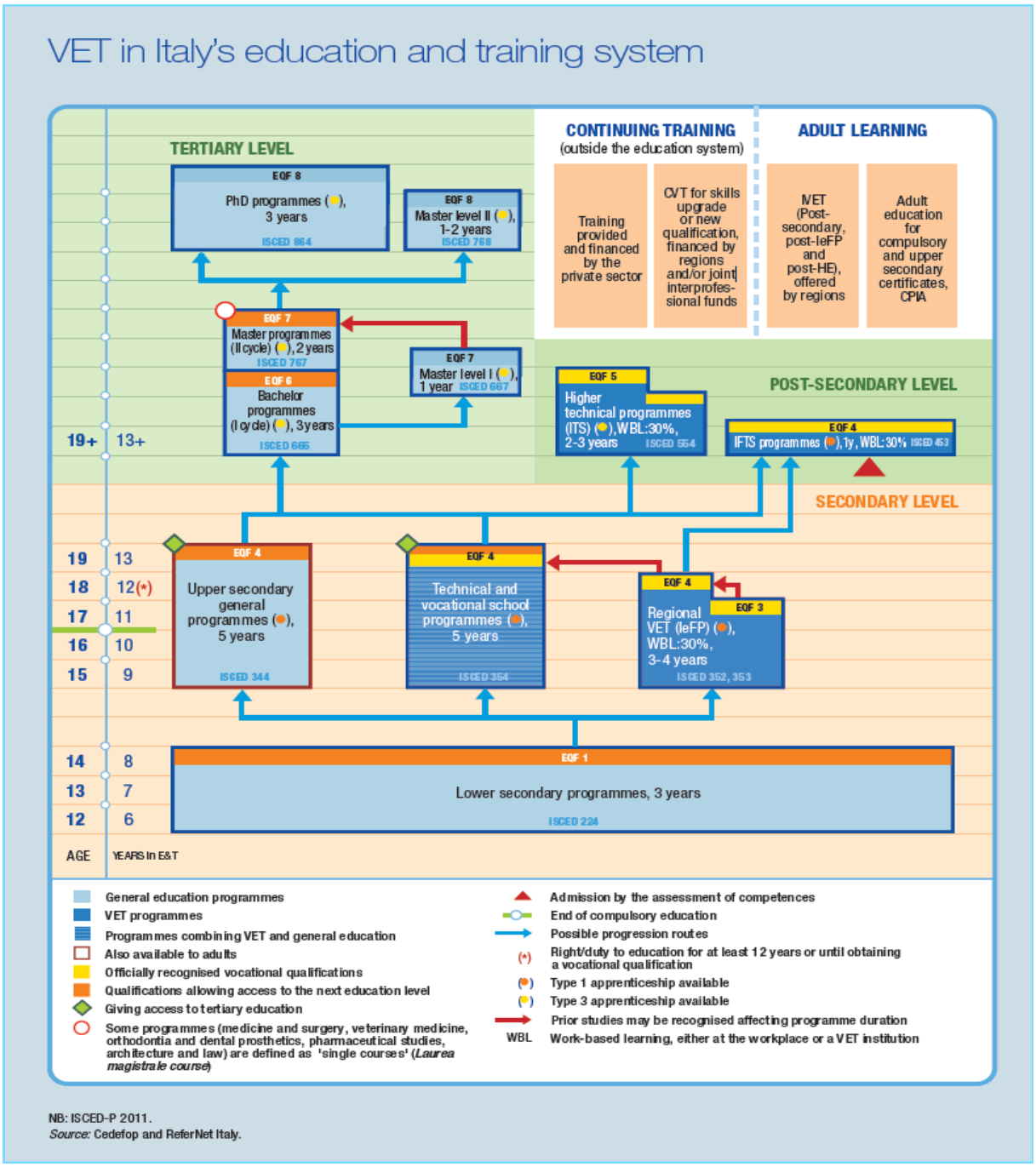
4.3.3 Italy

4.3.3.1. Basic structure of VET



NB: ISCED-P 2011.
Source: Cedefop and ReferNet Italy.

4.3.3.2. Distinctive features of VET

All young people have the 'right/duty' (diritto/dovere) (Law 53/2003, p. 7) to pursue their education and training for at least 12 years before reaching age 18. The aim is that young people should not leave education and training without a qualification. However, compulsory education lasts 10 years, up to 16, and includes the first two years of upper secondary general education or VET. Young people finish lower secondary education at age 14. At this stage, learners sit a state exam to acquire a certificate (EQF level 1) which grants admission to the upper secondary level where young people can choose between general education or VET. At upper secondary level, young people may opt for:

(a) five-year programmes which include the two last years of compulsory education and three years (under the right/duty of education and training) in:

(i) high schools (licei). These provide general education programmes at upper secondary level;
(ii) technical schools;
(iii) vocational schools.

High schools (licei) offer artistic, classical, linguistic, scientific, human sciences, music and dance strands. Within the artistic strand, learners can specialize in figurative arts, architecture and environment, design, audio-visual and multimedia, graphics or stage design in the second period. The qualifications awarded after successful completion of high school, technical and vocational school are at EQF level 4 and a state leaving exam at the end of them gives access to higher education;

(b) Regional Education and Vocational training courses (IeFP) (EQF 3 or 4);

(c) an apprenticeship-type scheme (after age 15 – EQF 3 or 4).

At post-secondary level, the Italian system features higher technical training (IFTS, ITS) and short programmes or courses (post-IeFP and others).

VET courses also exist at post-higher education level.

Tertiary education (ISCED levels 665, 667, 766, 767, 768, 864) is divided into higher education programmes at the university and higher education programmes at non-university institutions:

(a) universities: can be public or private and follow the three cycles of the Bologna structure: bachelor (laurea); master (laurea specialistica/magistrale); and specialisation or PhD programmes (masters universitario di secondo livello, dottore di ricerca);

(b) higher artistic and musical programmes (alta formazione artistica e musicale) which are non-university programmes based on the three-cycle structure.

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Italian VET provision also offers opportunities in adult education and Continuing Vocational Training (CVT).

In Italy, the term vocational education and training tends to be 'reserved' for specific programmes primarily under the remit of the regions and autonomous provinces (such as IeFP). From a European perspective the term 'education and training' comprises all types and levels of general and education and vocational education and training (VET). Irrespective of the provider or governance scheme, VET can take place at secondary, post-secondary or tertiary level in formal education and training or non-formal settings including active labour market measures. VET addresses young people and adults and can be school-based, company-based or combine school- and company-based learning (apprenticeships). Therefore, the term VET also covers the technical and vocational schools.

4.3.3.3. Challenges and policy responses

What are the main needs that enterprise indicates?

The policies to support the renewal of machinery and equipment to face the challenge of Industry 4.0, together with a more favourable economic scenario for spending decisions, support business investments. These trends are part of a context of restarting the investment and production cycle at international level which, after a weaker phase, also involves the European area.

The reactivation of world trade boosts the demand for Made in Italy technologies within the global value chains. It should not be forgotten that Italian manufacturing is characterized by a specialization oriented towards the production of intermediate and semi-finished goods and is significantly affected by integration with foreign markets. More generally, the 4.0 revolution is giving new impetus to the transformation process underway in the manufacturing sector and automation technologies central to this phase of renewal.

What are the priorities for the government, enterprises, and educational institutions?

The OECD21[23] PAL Priorities Adult Learning dashboard identifies the efforts made in last 15 years by Government to improve the Italian VET offer.

Despite this, there are two key factors that underline the need for further reform of continuing training:

The first factor is linked to the implications of the technological revolution on the Italian labour market, with an estimated 50.7% of jobs with the potential for automation, which translates into a significant

[23] http://www.oecd.org/employment/skills-and-work/adult-learning/dashboard.htm

risk of outdated skills. This is closely linked to the second demographic factor of an ageing population. There are 3.5 elderly people for every 10 adults of working age, the highest rate in the OECD after Japan.

Furthermore, in Italy 38% of adults have low levels of linguistic or mathematical skills, one of the lowest levels among OECD countries.

In this context, "renewing the system of continuing education is essential to enable adults to access training opportunities that are relevant and aligned with market needs".

To tackle these challenges, it is considered a priority to follow the Industry 4.0 Plan, promoting the financial facilitation measures (grants or tax relief) for companies wishing to invest in technological innovation linked to staff upgrading plans (technology + training).

It is important to follow up the second phase of the Industry 4.0 plan, which provides incentives to encourage networks between companies, universities and research centres, strengthening the integration between innovative developments and employment. This priority includes the Digital Innovation Hubs, the Competence Centres and further initiatives to consolidate the cross-fertilisation of know-how between Research and Work.

The Ministry of Education, University and Research (in Italian: Ministero dell'Istruzione, dell'Università e della Ricerca or MIUR) is the ministry of the Italian government for the national education system, the Italian universities and research agencies. The MIUR has not developed a general approach regarding skills mismatch in the automotive sector yet. However, the Industria 4.0 National Plan (I4.0)[22], launched in February 2017 by the Italian Ministry of Economic Development (in Italian: Ministero per lo sviluppo economico or MISE) embraces strategic guidelines aiming to transform manufacturing methods in general, including the automotive sector, with a focus on skills and advanced technology, as well as the support of the digitization of the Italian economy. Although a national holistic approach is not available yet, Italian regions with a solid tradition in the automotive sector have provided concrete answers to the emerging needs of the automotive industry, creating specific training courses and university courses.

During the Desk-Research activity into this country, a number of "recently implemented innovative initiatives" have been analysed:

[22] https://www.mise.gov.it/index.php/it/component/tags/tag/industria-4-0

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1. GM Global Propulsion system Academy (Torino, Piemonte region)

GM Global Propulsion Systems Academy is a partnership among ANFIA, General Motors and Politecnico di Torino that aims at developing a structure that will interconnect Automotive Industries and Academic environment.

This Academy will provide a list of interdisciplinary courses to Politecnico di Torino students and Employees coming from European Automotive Suppliers. Training courses will be related to quality manufacturing processes and tools, purchase techniques and engineering standards. Classes will take place in Politecnico di Torino and will be provided by experienced General Motors employees. After completion of each class all participants will get a participant's Certification and students will be able to get academic credits (certification IATF).

2. Dallara Academy (Parma, Modena, Bologna, Area Romagna, Emilia Romagna region)

"Motor Valley" district has created a synergy between universities, training centres and companies to train and engage people in the world of work. Dallara centre has developed a section designed for schools ("medie" and "superiori") with educational workshops on physical sciences and aerodynamics of the vehicle. Dallara Academy also collaborates with MUNER in relation to the implementation of two degree courses:

- **Master's Degree in Advanced Automotive Electronic Engineering**: for those who wish to become engineers with an in-depth knowledge of the design and engineering of the most advanced electronic, IT and connectivity systems in the automotive field.
- **Master's Degree in Advanced Automotive Engineering**: dedicated to students who wish to become engineers with an in-depth knowledge of the various aspects related to the design and development of high technology motorcycles.

3. Muner (Parma, Modena e Reggio Emilia, Ferrara, Bologna, Emilia Romagna region)

MUNER - Motorvehicle University of Emilia-Romagna has its roots in the Motor Valley, where the most famous automotive companies in the world offer their know-how and the most innovative technologies for students who want to become new professionals in the automotive field and are willing to design road and racing vehicles, more sustainable propulsion systems, the subsystems for intelligent functions and production facilities in the pursuit of Industry 4.0. All Muner's Degree courses are Inter-University Master's Degree Programmes (the so-called "Laurea Magistrale" in Italy) related to the LM-33 Degree Class according to the Ministry of Education, University and Research classification (MIUR). After a common semester held in Modena campus, the following six curricula are envisaged:

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1. Advanced automotive electronic engineering
2. Racing car design
3. High performance car design
4. Advanced sports car manufacturing
5. Advanced powertrain
6. Advanced motorcycle engineering

4. Polo Innovazione Automotive - Higher Technical Institute of Mechanical system (Chieti, Abruzzo region)

Higher education Technical Institute (HTS) for Mechanics System is a "Special school of technology" introduced into Italian national legislation in 2008. The main objective is to organise short cycle technical training courses (5° EQF, duration: 1.800 hours) in mechanics for high school graduates. The courses offered are innovative because they are based on the analysis of new strategic scenarios in terms of innovation; eco- efficiency, green energy, innovative materials, quality of processes and traceability. All these issues are continuously evolving for new global automotive companies. The joint presence of businesses together with the University and technical schools guarantees a solid foundation for skills transfer from the manufacturing worlds educational supply chain to students. Both the postgraduate training, the orientation and continuous training become synergic resources for the Automotive Innovation Pole which provides expertise to prepare human capital to meet the demands of the job market.

5. Politecnico di Torino (Torino, Piemonte region)

Politecnico di Torino has different cutting-edge courses in the field of automotive, both for bachelors and for master's degrees. Also some post graduate degree courses are planned. Examples include:

- Automotive Engineering, Laurea (1st degree and Bachelor-level of the Bologna process)
- Automotive engineering (Laura magistrale – masters degree)
- Energy Management For Automotive Powertrains (Italian masters II level)

6. Politecnico di Milano (Milano, Lombardia region)

One of the most innovative postgraduate courses at Politecnico di Milano is "Transportation & Automobile Design". Designed with Volkswagen Group Design, the goal of this Specializing Master is to train a professional designer to develop her or his own creativity, while innovatively integrating it with the academic knowledge specific to the syllabus. At the same time, the student is expected to experience the whole style-development process typical of the automobile industry. This Specializing Master is designed to enable graduates in industrial design, engineering or architecture who are interested in a career in automobile design to bring rigorous focus to their curriculum.

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7. AgenForm Training Services Agency (Agenzia dei Servizi Formativi) (Cuneo, Piemonte region)

AgenForm Training Services Agency (Agenzia dei Servizi Formativi) offers training activities. The organisation combines the heritage of the provincial vocational training centres with current local needs in terms of training, orientation and advice. One of the most interesting course (corso di Istruzione Formazione Tecnica Superiore (IFTS)) is “Tecniche Di Disegno E Progettazione Industriale”, open to young people and adults (unemployed or employed) with a diploma of secondary school.

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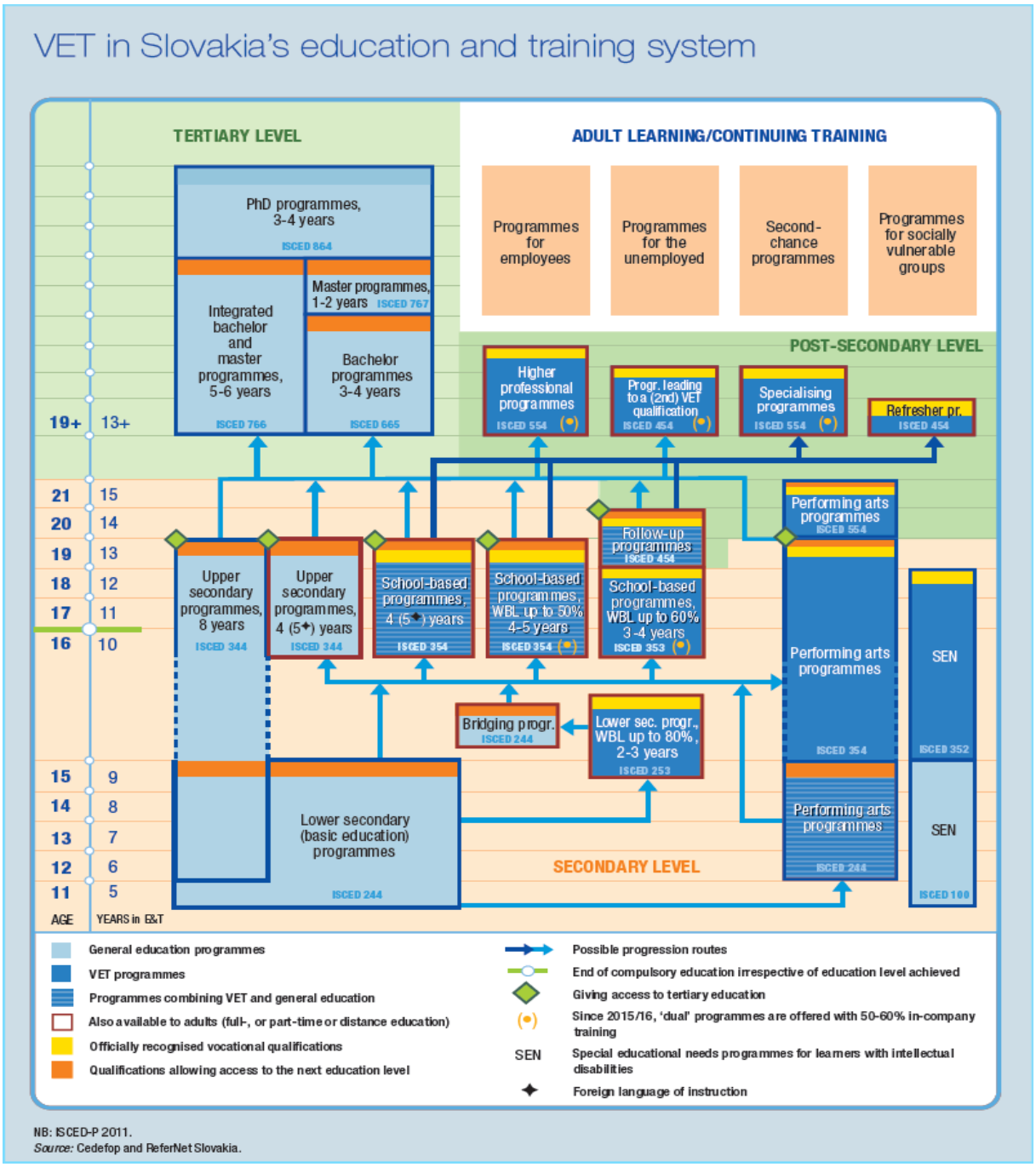
4.3.4 Slovakia

4.3.4.1. Basic structure of VET



NB: ISCED-P 2011.
Source: Cedefop and ReferNet Slovakia.

4.3.4.2. Distinctive features of VET

Employment policies are developed by the labour ministry and implemented by the public employment services (central office with a network of 79 district labour offices). In December 2014, the national employment strategy 2020 (Ministry of Labour, Social Affairs and Family, 2014) was approved by the government. The labour ministry prepares and submits to the government and the parliamentary committee a report assessing the state and the development of social affairs on an annual basis. This is based on socioeconomic indicators. VET has a limited role in implementing active labour market policies.

The education and training system comprises:
(a) pre-school education (ISCED 0);
(b) integrated primary (four years, ISCED 100; EQF 1) and lower secondary general education (five years, ISCED 244; EQF 2) (hereafter basic education);
(c) lower secondary VET (ISCED 253; EQF 2-3);
(d) upper secondary general education (ISCED 344; EQF 4);
(e) upper secondary VET (ISCED 353; EQF/SKKR 3 and ISCED 354; EQF 3-4);
(f) post-secondary non-tertiary VET (ISCED 454; EQF 4 and ISCED 554; EQF 5);
(g) academic higher (tertiary) education.

Although VET is strictly regulated by the state and is mainly provided by schools, Slovakia does not have a national strategy aimed specifically at addressing the skills and competence needs of the automotive industry. There is now a greater involvement of businesses in informing vocational schools about the skills and qualifications needed through sector councils, the creation of which was inspired by the British model. It is based on dual agreements between secondary vocational schools and enterprises. Companies are allowed to sign practical training contracts with pupils before they enter secondary vocational school (SOŠ), with the enterprise and secondary school reaching agreement on the provision of "dual" VET.

In contrast to the traditional dual model in German-speaking countries, learners are regular students of SOŠ and not employees of the company.

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4.3.4.3. Challenges and policy responses

The Ministry of Economy has prepared an „Action Plan for the Development of Electromobility in Slovakia"[23] including the "*Adjustment of electrical qualification for production and service of electric vehicles"* measures for the development of VET: Background and requirements for implementation of the measure: ensuring a sufficient number of qualified employees for the automotive sector with the necessary qualifications corresponding to the increased demand for electric vehicles. The proposal requires the creation of framework conditions for the implementation of the measure on the basis of which it will be possible to create a professional qualification in the field of electrical engineering, defining a separate activity for carrying out the development, production and repair of electric vehicles. The Ministry will be involved in the creation of a new qualification, defining the necessary knowledge, skills and competences of each graduate of the educational program in the form of the qualification and assessment standard of the qualification, which will also subsequently serve to verify professional competence at various levels of the qualification framework. The creation of a new qualification card will require agreement of the Alliance of Sectoral Councils as well as the preparation of a new occupation on the National System of Occupations (NSP). Subsequently, it will be possible to include the qualification in the National Qualifications Framework and the National Qualifications Framework of the Slovak Republic).

[23] https://www.mhsr.sk/search?search=ak%C4%8Dn%C3%BD+pl%C3%A1n+rozvoja+elektromobility

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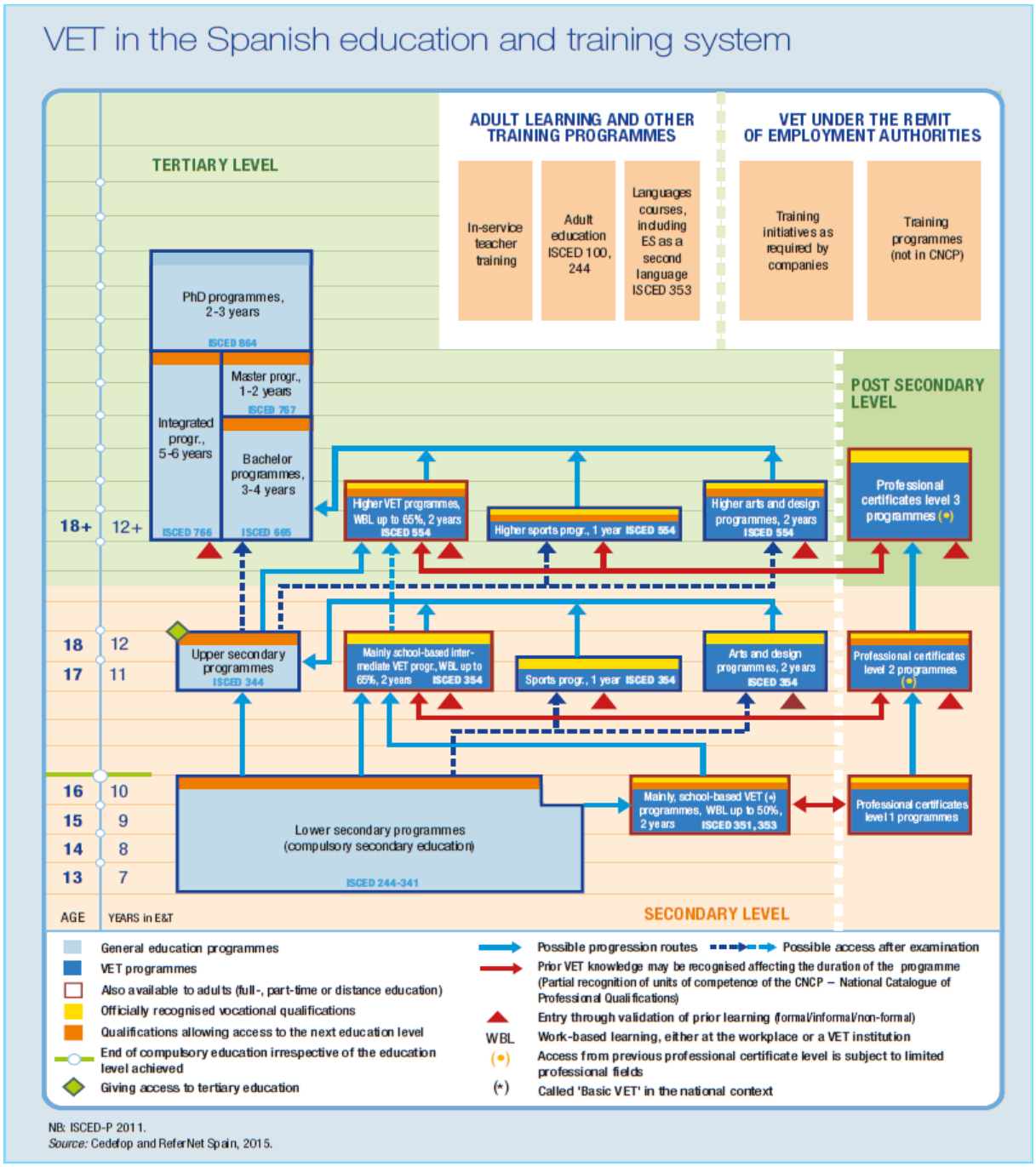
4.3.5 Spain

4.3.5.1. Basic structure of VET



NB: ISCED-P 2011.
Source: Cedefop and ReferNet Spain, 2015.

4.3.5.2. Distinctive features of VET

The modernization of VET and its flexibility are at the heart of Spain's education and employment policies. Vocational education and training is primarily the responsibility of the Education and Employment Authorities. The national system for qualifications and vocational training is the umbrella for vocational education and training programs, leading to formal qualifications awarded either by the education or employment authority. The General Council for Vocational Training is a government advisory body for VET policy; it consists of representatives of national and regional public authorities and social partners such as business organizations and trade unions. Stakeholders are involved in the design of all VET qualifications in the education system and the development of professional standards in all sectors of the economy together with the creation of a national register (catálogo nacional de cualificaciones profesionales (CNCP)). They serve as a reference point when designing or updating VET qualifications and programs to ensure that they are relevant to labour market needs. The Office for Vocational Education and Training offers basic, secondary and higher VET qualifications (VET diplomas, ISCED 3 to 5). The programs last for two years (2000 hours), with training in the company (minimum 20%) and VET school (maximum 80%)[24] Work learning takes place mainly in workshops, laboratories, simulations or at the workplace; 30% of teaching relates to applied theory. It is also possible to acquire VET qualifications through two-track programs (with or without an employment contract). In such cases, the duration is up to three years. Basic VET programs are offered in the last year of compulsory education when students are 15 years old. They enable students at risk of leaving education without qualifications to remain in education and training. Upon completion of the two-year program, students may move to secondary vocational education and / or complete compulsory education (ESO) opening a general educational pathway.

Intermediate vocational training programs usually start at the age of 16 after completion of compulsory education and allow access to higher vocational training through admissions. Tertiary or higher education includes higher education and tertiary professional education.

Qualifications in the Spanish University Qualifications Framework (MECES) have been linked to the European University Qualifications Framework (EHEA-QF). The credit transfer option allows senior VET graduates to advance to university and graduates to undertake additional studies in higher vocational education and training. Those over 16 years of age can also take part in vocational training programs in the field of labour offices with qualifications at three different levels (professional certificates) corresponding to their professional profile. The access requirements and duration vary depending on

[24] *CEDEFOP: Spotlight on VET - SPAIN*

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the learning outcomes to be achieved at each level (from 200 to 1110 hours). A compulsory on-the-job training module is included in the training programs at all three levels. Applicants for level 2 or 3 VET programs that do not meet the entry requirements should follow a mandatory core / key skills training module (mother tongue, foreign language and / or math). These programs can be considered initial or continuing VET depending on the pupil's education and professional experience. CVET enables people to improve their skills and obtain formal qualifications from education or work bodies. It can be financed by private contributions (companies and workers) or by public funds (active labour market policies). CVET includes a wide range of courses designed for different needs and skill profiles. Training is offered by public or private institutions accredited as providers of professional certificates and other accredited VET training centres.

Education and labour authorities have developed two different vocational qualifications systems: they share the same consultation bodies, but the management and objectives of their qualifications and VET programs are different. As professional standards in CNCP apply to both qualification systems, mutual recognition of some parts of the training is possible. There are also common rules for the verification of skills acquired through work experience and the extension of the dual principle. VET programs are modularized and include compulsory workplace learning at the end or during the studies. Pupils must pass all modules to get the appropriate qualifications. Modularization, however, allows for partial certification and reintegration for lifelong learning. Regional authorities may launch public calls for validation of non-formal and informal learning, depending on local or sectoral labour market needs. These procedures allow citizens to engage in further learning and become fully qualified. Demand for recognition may be due to the needs of society, the requirements of the social partners or the minimum qualification requirements of sectoral regulators. Unskilled adults can have their skills recognized or have formal qualifications through training. Key competency tests for advanced VET programs and professional certificate access have been developed. Online or virtual learning environments and platforms are being developed to facilitate access to VET programs. The recently introduced basic VET and easier access to middle VET has opened up progressive routes for young and adults with low or no qualifications. The dual principle was introduced at national level to increase the attractiveness of VET and to support young people in transition to the labour market. Participants in dual education programs (from 16 to 25 years old or up to 30 years until youth unemployment drops) can sign an apprenticeship contract (one to three years) and earn at least a minimum wage. At least 25% (first year) or 15% (following years) of training is dedicated to acquiring new skills at a specialized training centres or company[25]. Dual learning programs can also be based on agreement between

[25] *CEDEFOP: Spotlight on VET – SPAIN*

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society, school and pupil. Participants have student status (no age limit) and can benefit from scholarships depending on the Autonomous Communities.

4.3.5.3. Challenges and policy responses

In response to the significant increase in youth unemployment in recent years, the current VET policy is the main pillar of the National Strategy for Entrepreneurship and Youth Employment (2013-2016)[26] and the Spanish Strategy for Activating Employment (2014-2016). The aim is to improve VET standards, make them more attractive to young people and improve the management of public funds for education in employment. This is guaranteed by the accreditation of VET providers and by offering training leading to formal qualifications. Monitoring training outcomes, including the transition to employment, will also support the quality of training; to this end, a common training database is being developed. The social partners and regional authorities are involved in quality assurance in continuing vocational training.

[26] http://www.mitramiss.gob.es/ficheros/rse/documentos/eeej/EEEJ_Documento.pdf

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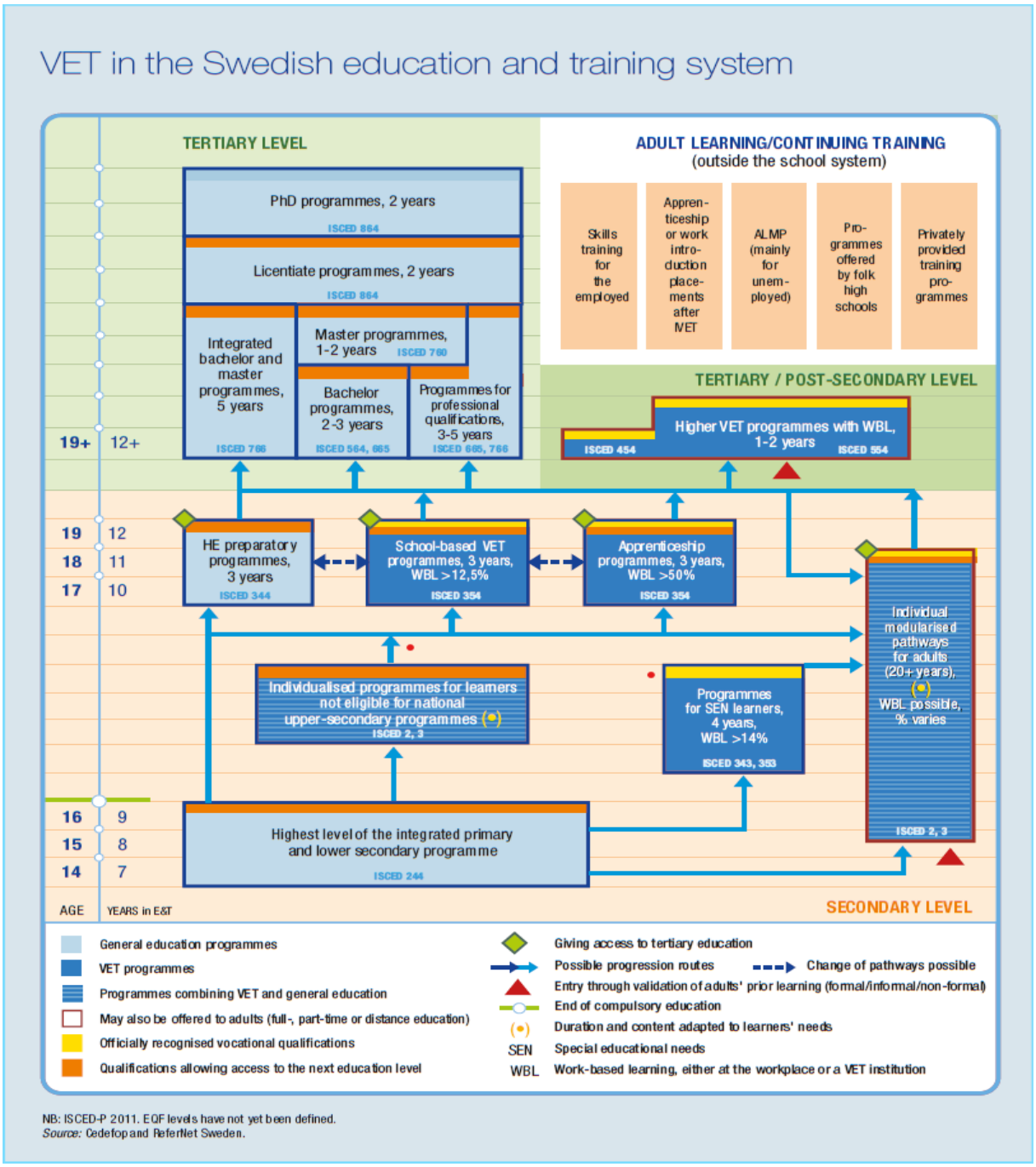
4.3.6 Sweden

4.3.6.1. Basic structure of VET



NB: ISCED-P 2011. EQF levels have not yet been defined.
Source: Cedefop and ReferNet Sweden.

4.3.6.2. Distinctive features of VET

Swedish VET includes programs and study tours in upper secondary education and non-academic and academic tertiary education. These are vocational programs (upper secondary schools) or preparatory programs of higher education. All programs are offered as school or apprenticeship paths and successful completion leads to a professional diploma.

Academic tertiary VET consists mainly of one- or two-year higher vocational education and training programs leading to a diploma or higher diploma in higher vocational education.

The specific needs and situations of the individual are always the starting point for adult education. Vocational Training at Work (APL) is compulsory in vocational secondary schools and represents at least 15% of the program[27].

In the upper secondary education pathways, more than half of the education takes place in the workplace. Academic higher education programs combine school education with on-the-job training (LIA) and at least a quarter of the program must be pursued as an LIA to obtain a higher degree in higher vocational education.

The Ministry of Education and Research is responsible for most of the education (this includes upper secondary schools, adult education and higher vocational education for VET). Upper secondary schools can be run by municipalities, district authorities, the state and private actors. The Swedish National Higher Education Agency approves providers and government grants for higher vocational programs. Providers will develop a training plan and programs should be developed and delivered in collaboration with the world of work. Courses and programs are financed by fees or companies and organizations, but public subsidies are also provided.

4.3.6.3. Challenges and policy responses

Since 2016, informal and private sector qualifications and certificates can be referred to the Swedish National Qualifications Framework (SeQF).

Modularized programs allow upper secondary school students to transfer one or more subjects to another program and allow students to build on their earlier studies and, for example, gain access to higher education. Also in higher education, knowledge, skills and competences acquired through training, work experience or other means may be validated and recognized as part of the program. Training providers are responsible for this process.

[27] *CEDEFOP: Spotlight on VET-SWEDEN*

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To strengthen cooperation between education and the world of work, the National Program Councils include social partners for each of the national vocational programs in secondary schools. The public employment service representatives and the social partners are members of the Labor Market Council, a body linked to the Swedish National Higher Education Agency. The Councils are a permanent platform for dialogue on the quality, content and organization of VET between national agencies and stakeholders.

In Sweden, cooperation at regional level, often concentrated in areas with a high share of automotive production, plays an important role in addressing the automotive industry's VET requirements in relation to structural change and electromobility. Organizations such as the Swedish National Association (FKG - Fordonskomponentgruppen AB) and the Swedish Strategic Research Foundation are members of reference groups, where they work together with regional authorities and manufacturing companies to address needs, i.e. areas to focus on, how to adapt the education system, what businesses need and how they need to change. This is followed by a discussion with VET providers to provide schools with as much information as they need to develop a new curriculum. One example of good practice is cooperation with Chalmers University of Technology, where automotive engineering is a priority research area[28]. Chalmers hosts the Swedish hybrid centre (SHC), a collaborative initiative between Swedish universities and the automotive industry. Research is focused on batteries, powertrain control and electric motors.

[28] http://www.chalmers.se/

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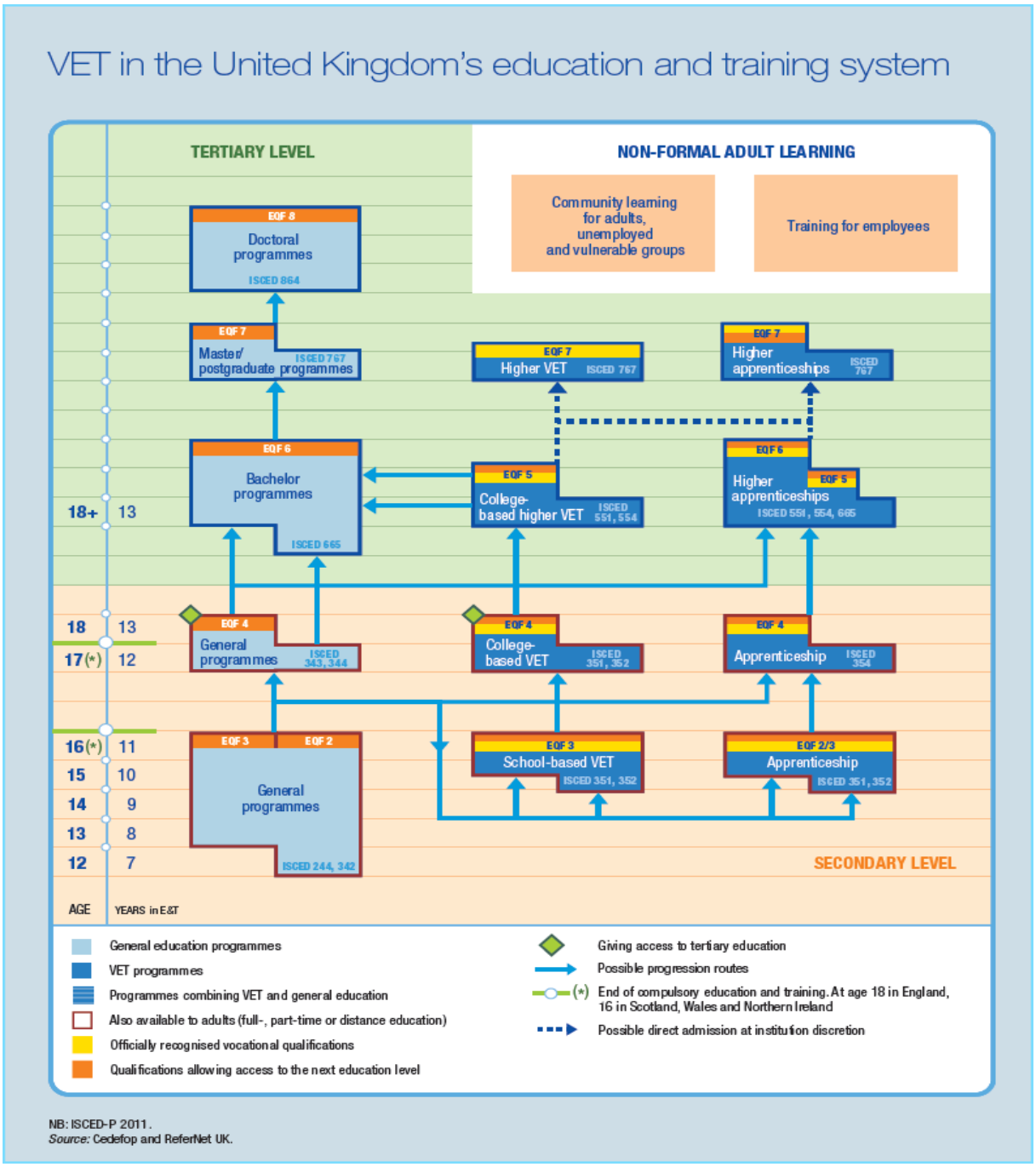
4.3.7 United Kingdom

4.3.7.1. Basic structure of VET



NB: ISCED-P 2011.
Source: Cedefop and ReferNet UK.

4.3.7.2. Distinctive features of VET

VET is available at secondary schools and universities in the form of broad introductory courses and specialised in-service training. Education or training is compulsory up to the age of 16 (under 18 in England)[29], but most young people continue to learn after this point. For students under 18, vocational training is funded by government agencies, while adult students are eligible for grants and loans.

From the age of 15, pupils can start accessing programs that combine general academic study with VET elements or specialized vocational programs that can take place in the school and workplace. VET is offered full-time and part-time; students may attend employer training on a block or daily basis or attend evening or weekend learning. The duration of the program varies, usually between one and four years.

Apprenticeships always include employment contracts and, in most cases, technical and professional qualifications and core, transferable skills such as counting, literacy and ICT. At higher education level, there is a well-established system for VET students who can advance to higher education. Candidates with an upper secondary qualification (EQF level 4) may have access to selected first-cycle university programs at institutional discretion. However, there is no automatic right to advance from one level of the qualifications framework to the next, since training providers and grant organizations can set entry requirements for individual qualifications.

Curricula create opportunities for students to combine qualifications and subjects, which means that a greater range of secondary qualifications can be used for higher education applicants. There are also good articulation opportunities in the UK to advance from higher vocational education and training programs (EQF level 5), such as foundation degrees and higher national certificates and diplomas, to the second or third year of a bachelor's degree in a related field. In some cases, outcome agreements lead to a guaranteed advance from one type of qualification and level of study to another type of qualification at another level of study. The unit-based structure of qualifications and their adaptation to qualification and credit frameworks opens up the possibility of transferring credits between qualifications in accordance with the recognition of prior training guidelines. British qualifications systems have also introduced major building blocks to support the European Credit System for Vocational Education and Training (ECVET) and are now working to implement it for international student mobility. Qualifications are designed by independent awarding organizations that also issue certificates. Some offer a wide range of qualifications, often both general academic and vocational;

[29] *CEDEFOP: Spotlight on VET – UNITED KINGDOM*

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smaller ones often specialize in a particular profession. Many VET students are adults. Adult and continuing education is part of the formal education system, but is also offered as non-formal education to employers and training providers. Trade unions, employers' organizations, sectoral councils and other social partnerships are involved in providing adult education, developing educational resources and anticipating labour market needs. Employers are increasingly involved in the development of skills and qualifications.

4.3.7.3. Challenges and policy responses

The UK Government has delegated decision-making powers in several areas of political responsibility, including VET governance, to administrations in Scotland, Wales and Northern Ireland. Although similar systems exist in England, Wales and Northern Ireland, reforms create greater divergence and the Scottish system was in many ways different from others in the UK. England, Scotland, Wales and Northern Ireland have different governance, regulation and quality assurance bodies. There is a complex institutional framework in the VET sector in the UK, with VET in England as the policy-making body, while the Department of Education and the Ministry of Economy are responsible in Northern Ireland and the Scottish and Welsh Governments of Scotland and Wales. The UK skills market is jointly driven by government policies and private interests. This has led to a large selection of qualification and awarding organizations.

Adapting qualifications to employer needs and increasing employers' involvement in education and training are high priorities in the UK, such as the Government's plan to simplify higher education and training in England by creating clear pathways to occupations through employer-developed qualifications. The new regulated qualifications framework gives organizations greater freedom and flexibility to develop qualifications that meet specific labour market needs.

It is expected that qualifications will now be validated and supported directly by employers rather than following the normative rules and structures imposed by government agencies.

The Scottish Qualifications and Credit Framework maintains its structure and universities in Scotland are adapting their provision to the needs of employers and the Scottish economy through outcome agreements and a wide range of qualifications through their new regional governance structure. The Scottish Funding Council works with universities to ensure that outcome agreements address priority needs in their regions and contribute to improving the chances of young people's lives. The Commission for the Development of a Young Workforce in Scotland also encourages universities to develop more productive partnerships with local employers, schools and authorities. The Wales Credit and Qualification Framework recognises all forms of learning at all levels and abilities. Vocational

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qualifications have also been classified as IVET or CVET to clarify their purpose and whether they are initial or lead to professional competence. Qualifications Wales, as an independent agency, ensures that the Welsh qualification system and qualifications match students' needs. The reforms in the field of youth education, continuing education and apprenticeship in Northern Ireland aim to increase the skills of young people and provide clear paths from initial vocational education and training to apprenticeships - to be started at upper secondary level - and to higher education. Employers will be linked to education and training providers through the Strategic Advisory Forum and Sectoral Partnerships to ensure that the curriculum structure and training structure meet their needs. Specialised expertise centres are set up at universities to develop networks of professionals who share the latest developments in curriculum and skill training.

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5 SURVEY AND DESK RESEARCH EXPLANATION

This section outlines the structure of the "offer" survey and its constituent parts. This is summarised in the following **Figure 3**:

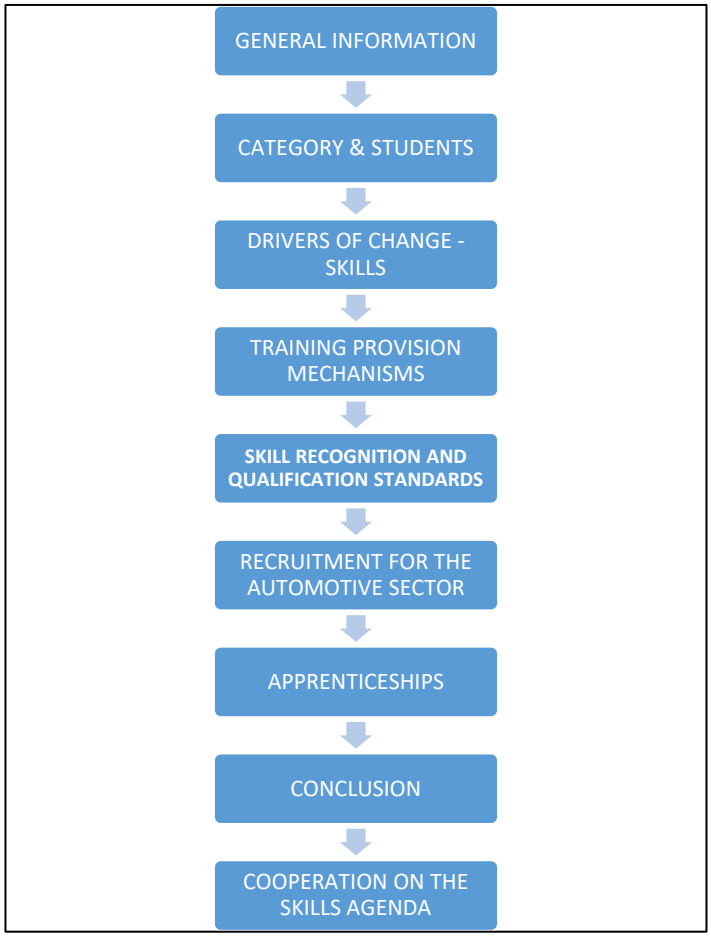

Figure 3: Questionnaire structure

The survey is divided into nine sections:

1. **GENERAL INFORMATION:** This section focusses on the characteristics of respondents

2. **CATEGORY & STUDENTS:** In this section there are questions relating to the VET offer in terms of students participating in, and courses offered by each organisation

3. **DRIVERS OF CHANGE – SKILLS:** this section is divided into two parts:

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- **First part**: respondents can assess the importance of each driver of change on a scale from 0 to 5. The timeframe can also be identified indicating the urgency of the driver of change (three main periods can be selected: by 2020; by 2025; by 2030).

  Second part: the survey encompasses 5 groups of skills. VET providers are asked to select skills included in their training offer. The last question allows respondents to specify if there are other skills related to the 5 groups of skills that are the subject of the proposed training course. For selected skills the responder indicates on which level are the particular skills provided and how many graduates per year obtain these skills.

4. **TRAINING PROVISION MECHANISMS:** after the skills assessment, respondents are asked to indicate how many graduates can be linked to each specific skill. Regarding the "training provision mechanisms", VET providers are asked to indicate which of the proposed training approaches are more effective for students and employers.

5. **SKILL RECOGNITION AND QUALIFICATION STANDARDS:** this section is designed to obtain information on the current use of specific "Recognition and Qualification frameworks" and the perceived importance of harmonisation of this activity at EU level. Using "standard(s)" in skills recognition and qualifications across the EU Automotive sector is particularly relevant to the mobility of skilled workers within the European Union.

6. **RECRUITMENT FOR THE AUTOMOTIVE SECTOR:** the aim of this section is to understand the views of VET providers on effective methods to support automotive sector recruitment.

7. **APPRENTICESHIPS:** designed to achieve a better understanding of future changes to apprenticeship training within the automotive sector.

8. **CONCLUSION:** this section was designed to collect further valuable information

9. **COOPERATION ON THE SKILLS AGENDA:** this section was designed to understand stakeholders' willingness to continue engagement with the DRIVES project in the future in order to develop a strong and constructive network across the automotive sector over time.

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5.1 ANALYSIS OF THE RESULTS

The "offer" Survey was designed to be comparable to the previous questionnaire (the "demand" questionnaire): most of the questions are linked to responses from the previous 'demand' survey and a harmonisation process has been necessary to finalise a structured map of the VET offer.

5.2 NORMALISATION OF CATEGORY & STUDENTS

In this section all the questions are closed. Only the last question asks if there are other categories of learners.

5.3 NORMALISATION OF DRIVERS OF CHANGE

Drivers of Change are key factors in transforming industry. Desk-based research was undertaken as the basis for this aspect of Work Package activities[30]. Five main "macro" Drivers of Change have been identified and presented to respondents:

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

A Drivers of Change 'normalisation' process followed a holistic approach in which new Drivers of Change identified by respondents were compared with the results of desk-based analysis; in almost all cases the normalisation has involved matching of "new" Drivers with those already identified.

5.4 NORMALISATION OF SKILLS

5 main categories or clusters of skills have been identified from previous demand-survey normalisation activity: 4 of these being "technical" and the 5th related to previously identified "soft skills". Specific job roles comprise different combinations of these skills.

1. **Technical knowledge profiles**: This category refers to the background of people in terms of education and expertise (at high level (engineer) or medium level (technician)). It includes the following normalised skills (in alphabetical order): electrical / electronic, electrochemical,

[30] *D2.9.1. Preliminary strategic analysis, 2019, DRIVES Project, Available at www.project-drives.eu*

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material sciences, mechanical, mechatronics, software development, sustainability and technical knowledge (generic). This final normalised skill refers to the technical knowledge requested for positions that do not require a high specialisation level.

2. **Vehicle systems**: This category refers to knowledge and expertise relating to the different new systems and functions in the vehicle as a product (in alphabetical order): alternative ICE powertrains and fuels, automated driving, connectivity, drivetrain, electrification, functional safety, system architecture. For electrification, several subcategories have been identified (2A, alphabetical order): batteries, electric motors, energy management, power electronics, system integration, thermal management.

3. **Life cycle / product – process chain**: This category refers to the different steps in the vehicle life cycle, covering the whole product and process chain (in sequential order): market analysis, R&D&I, design, product development, simulation, testing / validation, process engineering, production / manufacturing, internal logistics, sales, after-sales service, mobility services. For production / manufacturing, several subcategories have been identified (3A, alphabetical order): automation / robotics, maintenance, production organisation, specific manufacturing processes (for those cases where they were indicated).

4. **Digitalization**: This category refers to the specific digital enablers and the digital skills (in alphabetical order): 3D printing, artificial intelligence, big data / data analytics, cybersecurity, digital networks, digital skills (generic, other than technical and or management skills), digital twins, IoT & cloud, predictive maintenance, virtual product development & virtual testing.

5. **Soft skills**: (in alphabetical order): adaptability / flexibility, behavioural agility, change management, communication, continuous improvement, creativity, critical thinking, entrepreneurship, foreign languages, learnability, management & leadership, networking, problem solving, project management, resilience, teamwork.

1. Technical knowledge profiles
Electrical / Electronic
Electrochemical
Material sciences
Mechanical
Mechatronics
Software development

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Sustainability
Technical knowledge (generic)
2. Vehicle systems
Alternative ICE powertrains (alternative fuels)
Automated driving
Connectivity
Drivetrain
Electrification (See sub-categories below)
Functional safety
System architecture
2A. Electrification
Batteries
Electric motors
Energy management
Power electronics
System integration
Thermal management
3. Life cycle / product - process chain
Market analysis
R&D&I
Design
Product development
Simulation
Testing / Validation
Process engineering
Production / manufacturing *(see sub-categories below)*
Internal Logistics
Sales
After-sales service
Mobility services
3A. Production / Manufacturing
Automation / Robotics
Maintenance
Production organization
Specific manufacturing processes (Casting, Injection moulding, Paint spraying, Precision machining, Textile processes, …)
4. Digitalization
3D printing
Artificial Intelligence
Big data / Data Analytics
Cybersecurity
Digital networks
Digital skills (generic)
Digital twins
IoT & Cloud

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Predictive maintenance
Virtual product development & virtual testing
5. Soft skills
Adaptability /Flexibility
Behavioural agility
Change management
Communication
Continuous improvement
Creativity
Critical thinking
Entrepreneurship
Foreign languages
Learnability
Management & Leadership
Networking
Problem solving
Project management
Resilience
Teamwork

Table 4: Complete skills categories with related normalised skills

5.5 NORMALISATION OF CONCLUSIONS

This section was completely 'open ended' - respondents could share information and ideas in the absence of pre-defined categories, with the aim to gather extra information not previously included on the questionnaire. The normalisation process followed a logical approach by identifying the main concept outlined in each response.

5.6 NORMALISATION OF THE SECTION "COOPERATION ON THE SKILLS AGENDA"

After a "yes/no" request, the next three questions included in this section were open. No normalisation on these replies.

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6 RESULT OF THE SURVEY

Where possible each KPI has been compared with the relevant KPI in the "demand" questionnaire set out in the box <<Difference between demand and offer>>. The responses and detailed analysis from the perspective of "demand" are available in the Deliverable 2.7 "Forecasting dissemination" report[31]. All questions and relevant KPIs (where possible) have been analysed by overall value and filtered by the following selected categories of stakeholder:

- VET: including VET schools, Colleges and Universities
- INSTITUTE: including Research institutes and Accreditation centres/qualification bodies
- PRIVATE: all private companies (excluding other categories above)
- UMBRELLA ORGANISATION: associations of institutions, who work together formally to coordinate activities or pool resources

6.1 SAMPLE CHARACTERISATION

This section profiles responses based on information provided by respondents.

7.1.1. NUMBERS OF RESPONDENTS AND CATEGORIES

A total of 83 respondents completed, or partially completed the survey. Only those respondents completing at least the Drivers of Change section were included for further analysis. Respondents are divided into the following categories for analysis:

- Accreditation, certification or qualification body
- College
- Private company (excluding other categories listed)
- Research institute/centre
- University
- VET school
- VET Umbrella organisation

[31] https://www.project-drives.eu/en/publications

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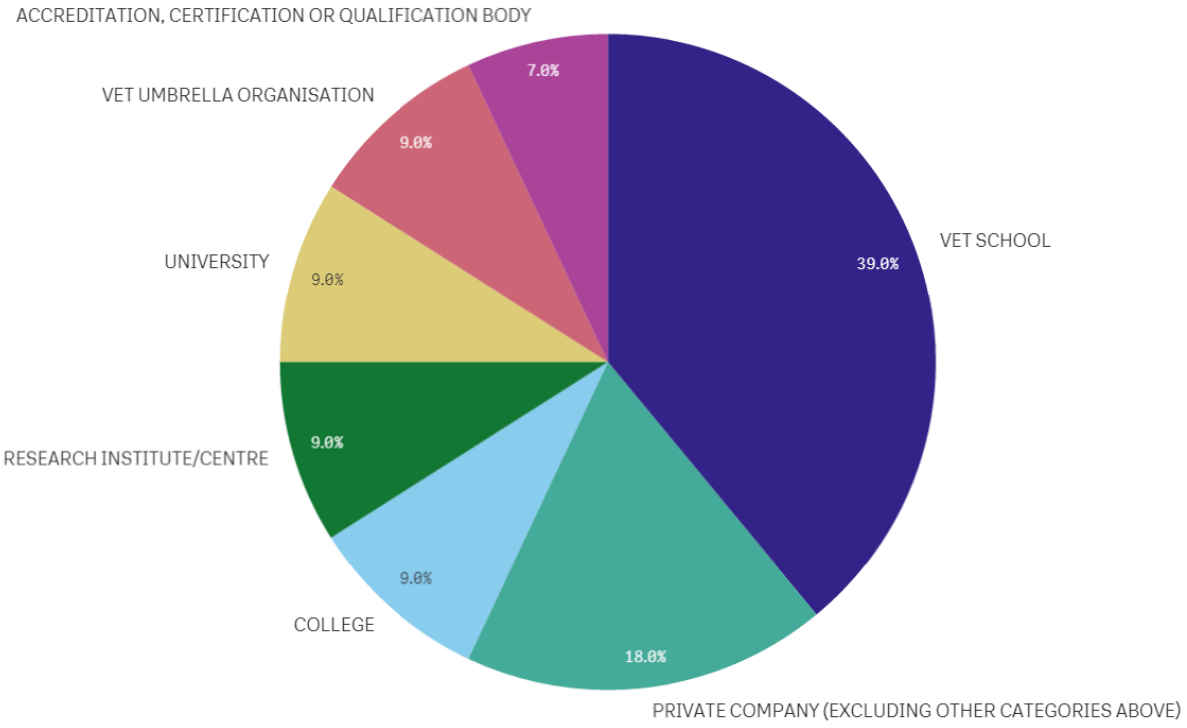

Figure 4: KPI 1.2 (Offer) Categories of Stakeholders

Figure 4 indicates that vocational training schools represent the largest category of respondents, accounting for 39% of the total. Also significant are private companies at 18%, followed by colleges, universities, vocational training umbrella organisations and other institutes and entities focused more on professional certifications related to the automobile sector.

7.1.2. RESPONDERS PER COUNTRY

The survey was disseminated to EU partner countries through project channels and partners networks, such as European umbrella associations and national associations and their members. As outlined in **Figure 6** (worldwide view) and **Figure 6** (European focus), there is a significant difference in the number of responses from Portugal (22%) and Spain (15.9%) by comparison with the rest of Europe, although most countries are represented to some extent. There are 11 countries where response rates are particularly low, representing 1.2% of the total in each case.

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Figure 5: KPI 1.4 (Offer) Responders per country – world – Overall sample

Figure 6: KPI 1.4 (Offer) Responders per country – Europe – Overall sample

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Country	Percentage
PORTUGAL	22,0%
SPAIN	15,9%
NETHERLANDS	8,5%
UNITED KINGDOM	8,5%
ITALY	6,1%
HUNGARY	4,9%
GREECE	3,7%
DENMARK	2,4%
ESTONIA	2,4%
FINLAND	2,4%
LITHUANIA	2,4%
MALTA	2,4%
NORWAY	2,4%
POLAND	2,4%
AUSTRIA	1,2%
CYPRUS	1,2%
CZECH REPUBLIC	1,2%
FRANCE	1,2%
GERMANY	1,2%
IRELAND	1,2%
LUXEMBOURG	1,2%
ROMANIA	1,2%
SLOVENIA	1,2%
SWEDEN	1,2%
UKRAINE	1,2%

Table 5: KPI 1.4 (Offer) Respondents per country – Overall sample

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7.1.3. CATEGORY & STUDENTS

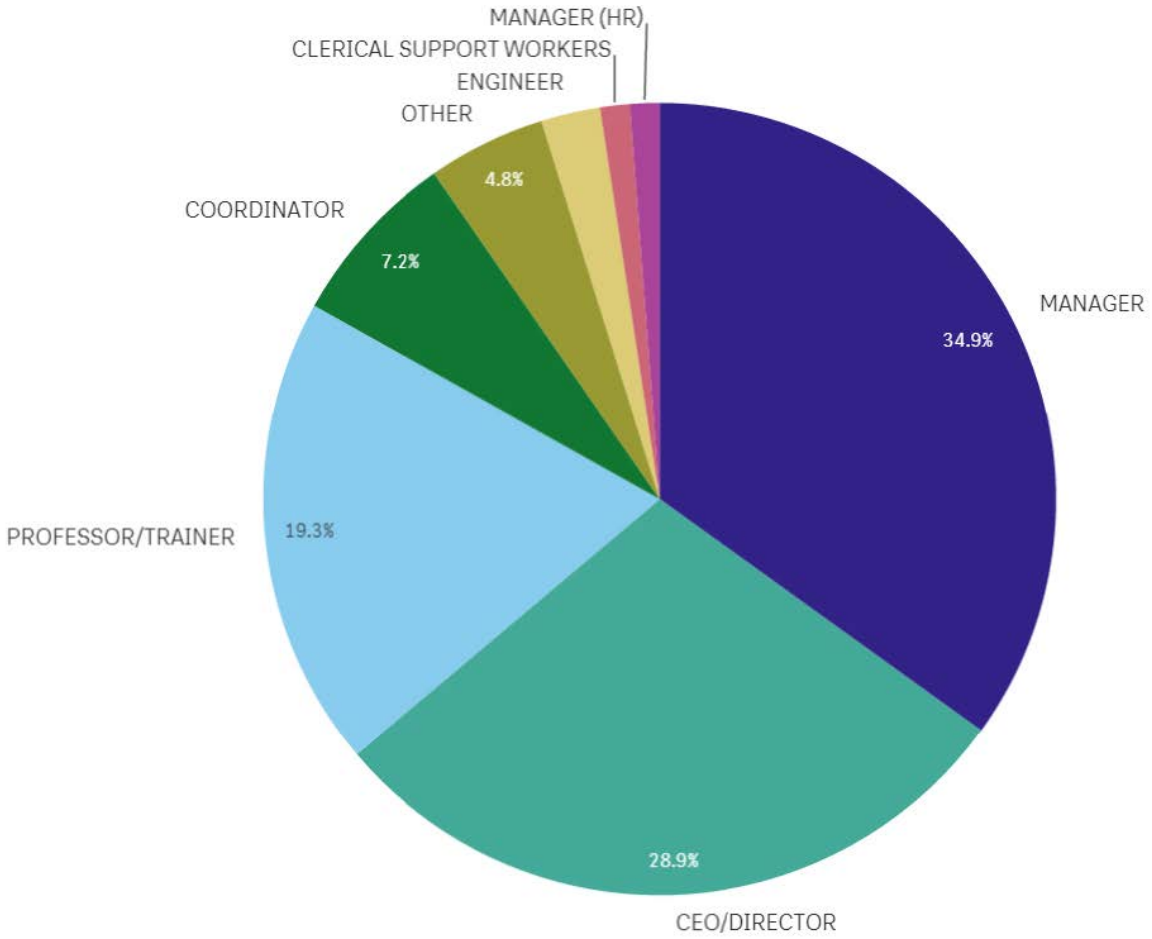

Figure 7: KPI 1.5 (Offer) Respondents Job Title

Figure 7 indicates that in most of the cases, it is managers or directors/CEO's of training schools or companies that have responded to the survey. However, the number of professors/trainers that have responded is also significant, representing almost a fifth of all respondents (19.3%).

7.1.4. COURSES PROVIDED GEO DISTRIBUTION

The available response options, regarding the on-site courses provided were:

- Europe (all)
- Specific countries
- Worldwide

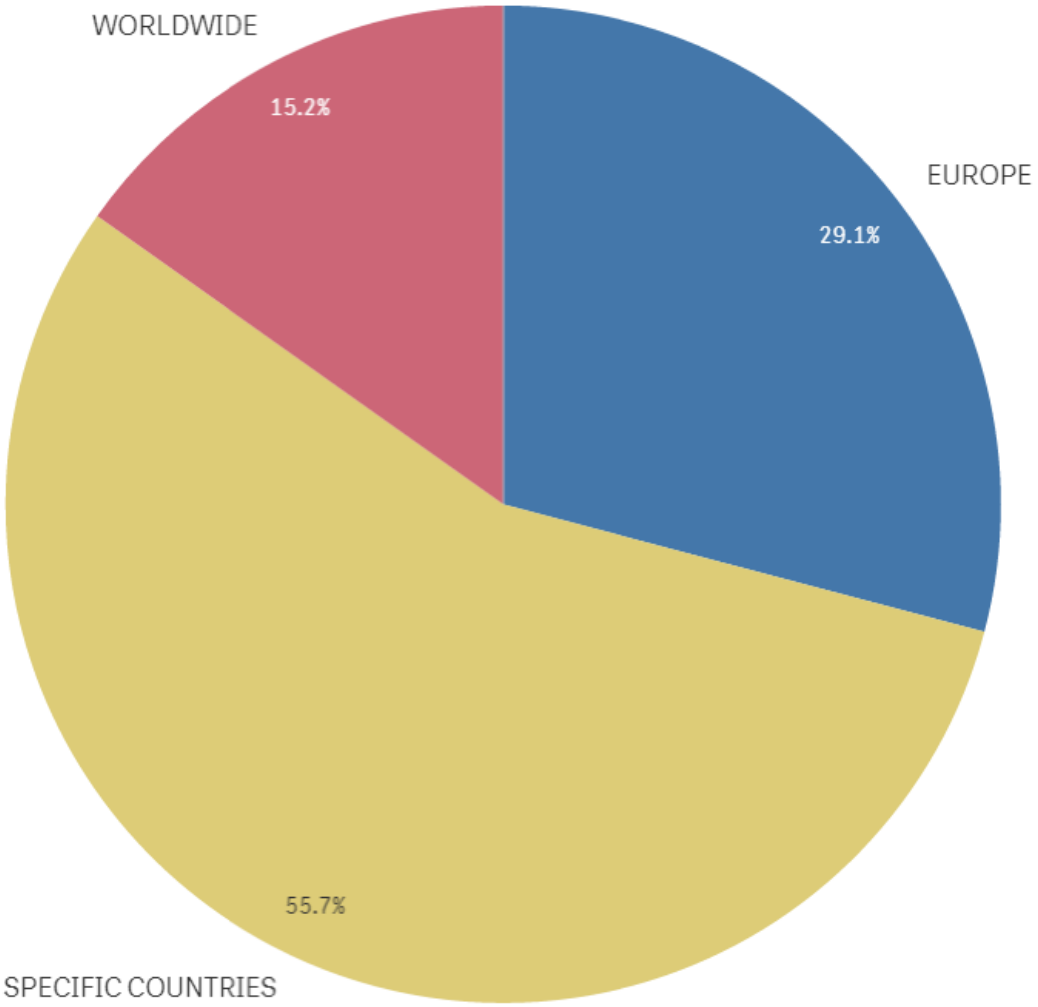

Figure 8: KPI 1.6 (Offer): course on-site provided – Overall sample

Figure 8 indicates that of those respondents providing courses on site, just over half (55.7%) did so in specific countries, 29.1% delivered EU wide courses on site, with the remaining 15.2% providing worldwide on site provision.

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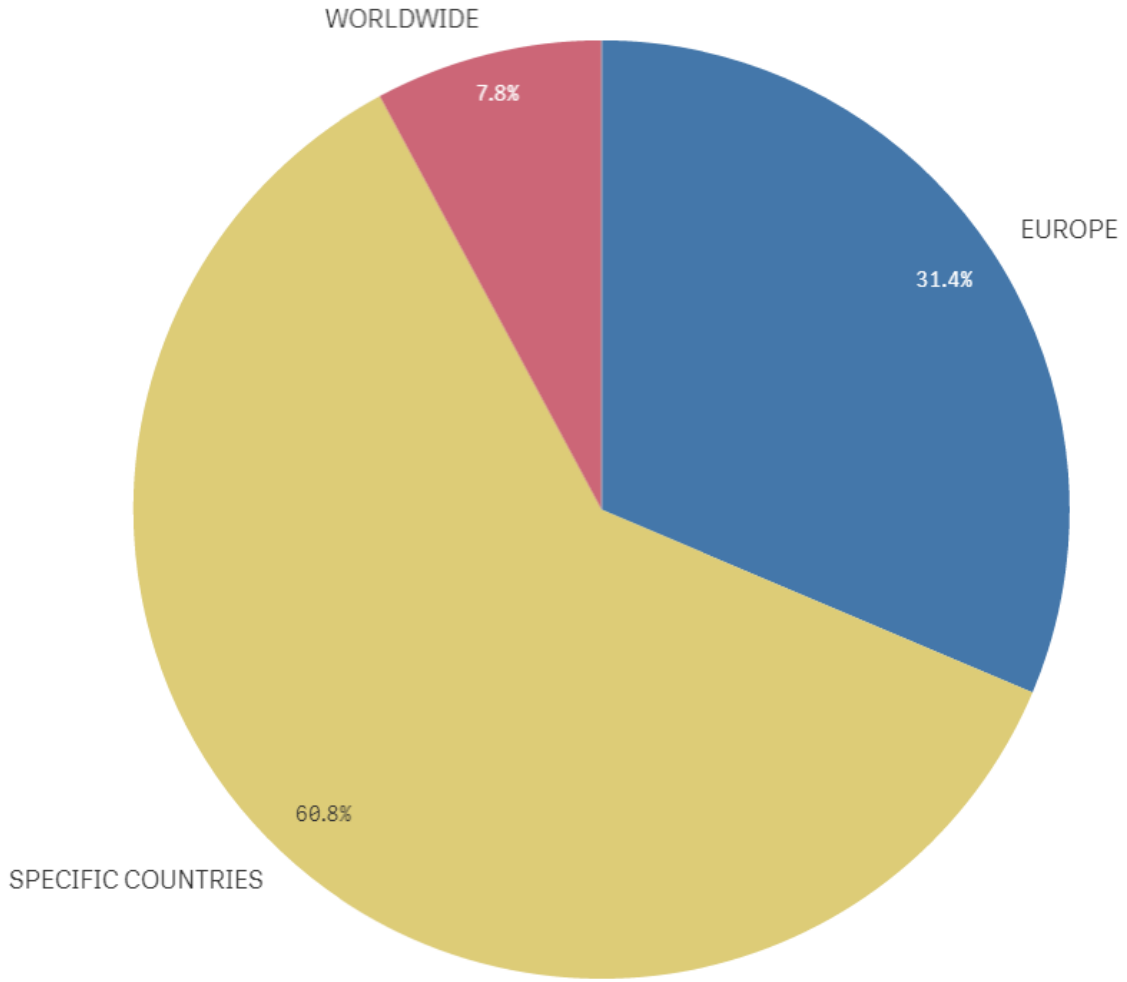

Figure 9: KPI 1.6 (Offer): course on-site provided – VET sample

With respect to Vocational Training schools**, Figure 9** indicates that of those respondents providing courses on site about six in ten (60.8%) did so in specific countries, 31.4% delivered EU wide courses on site, with the remaining 7.8% providing worldwide on site provision.

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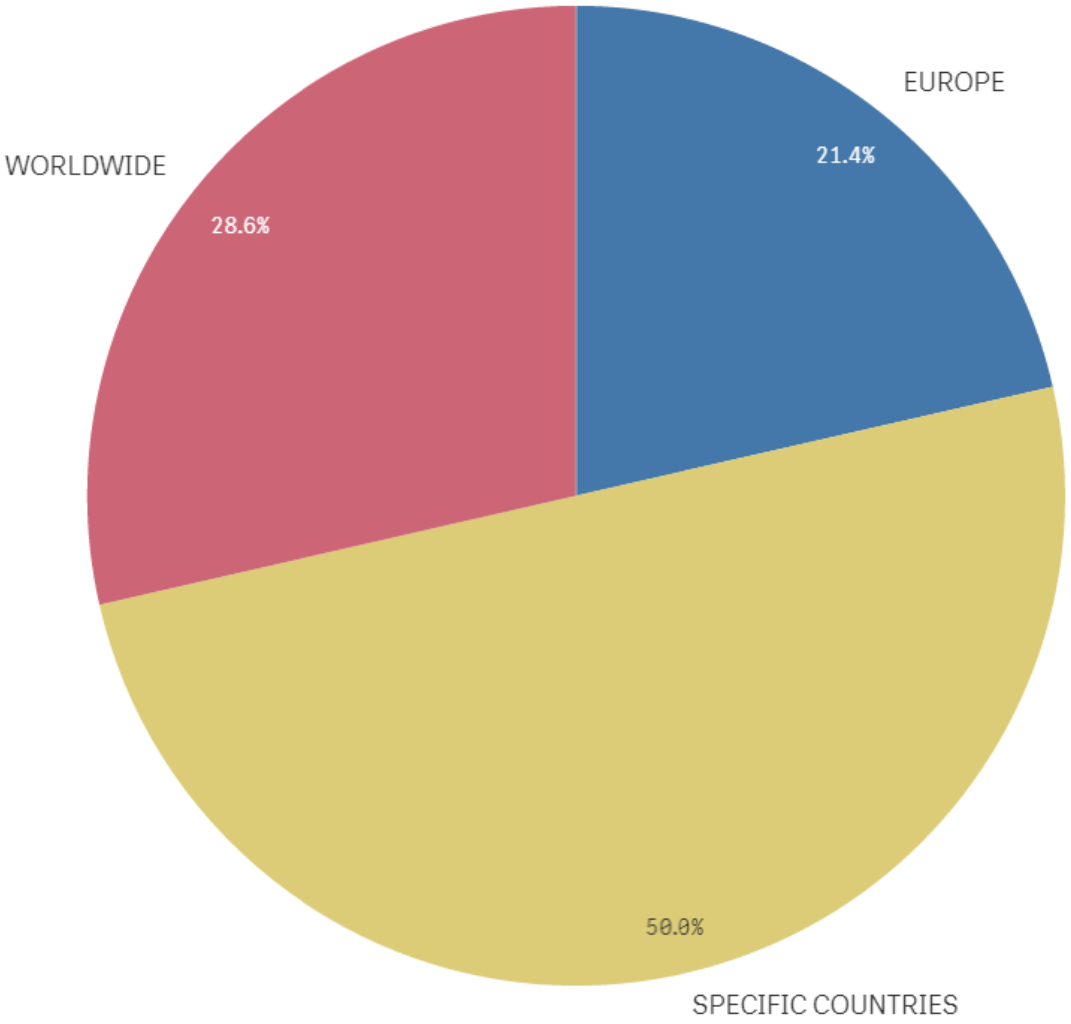

Figure 10: KPI 1.6 (Offer): course on-site provided – INSTITUTE sample

With respect to Institutes, **Figure 10** indicates that of those respondents providing courses on site, half did so in specific countries, 21.4% delivered EU wide courses on site, with the remaining 28.6% providing worldwide on site provision.

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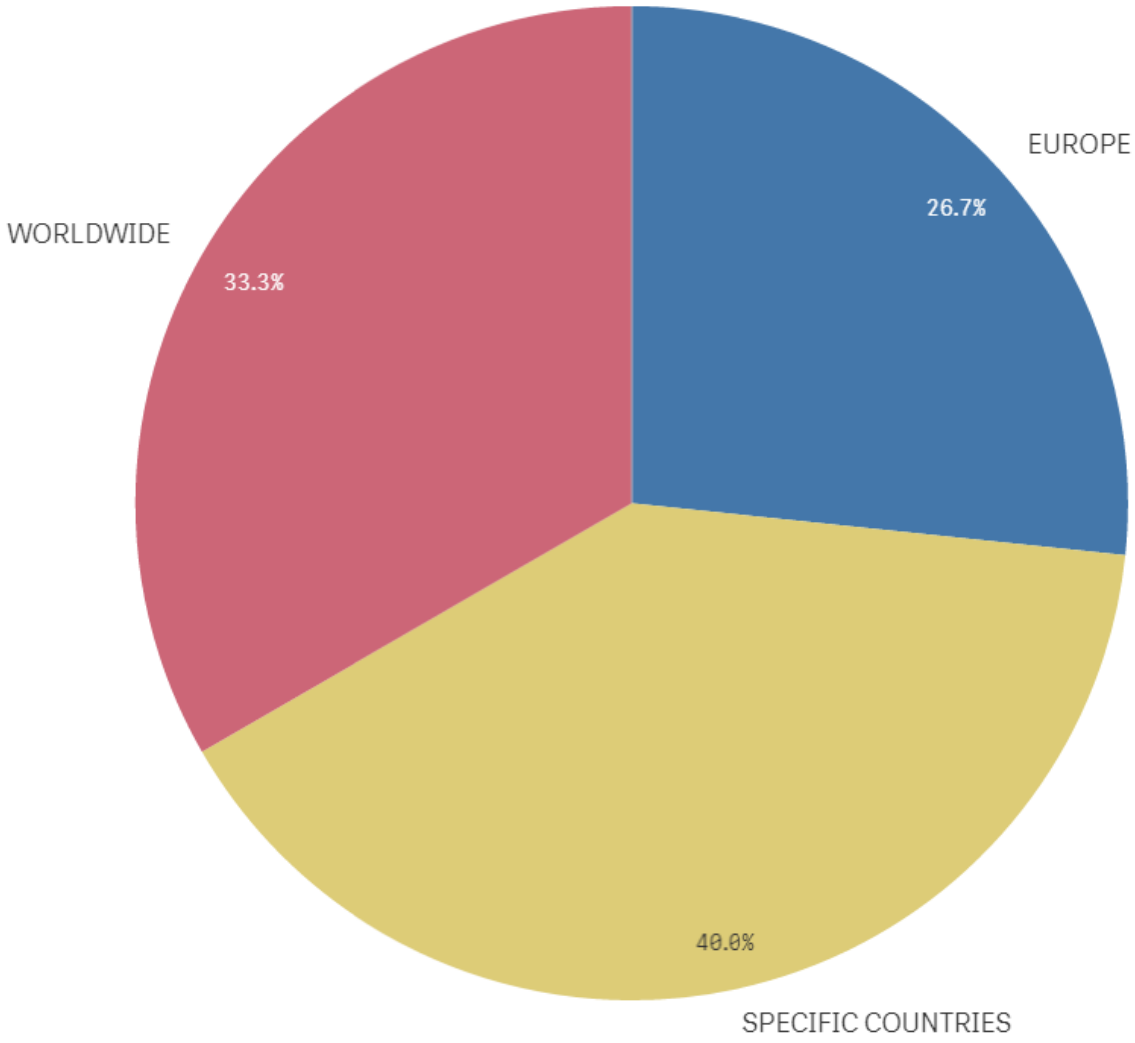

Figure 11: KPI 1.6 (Offer): course on-site provided – PRIVATE COMPANY sample

With respect to Private companies, **Figure 11** indicates that of those respondents providing courses on site, 40% did so in specific countries, 27% delivered EU wide courses on site, with a somewhat higher proportion (33%) providing worldwide on site provision.

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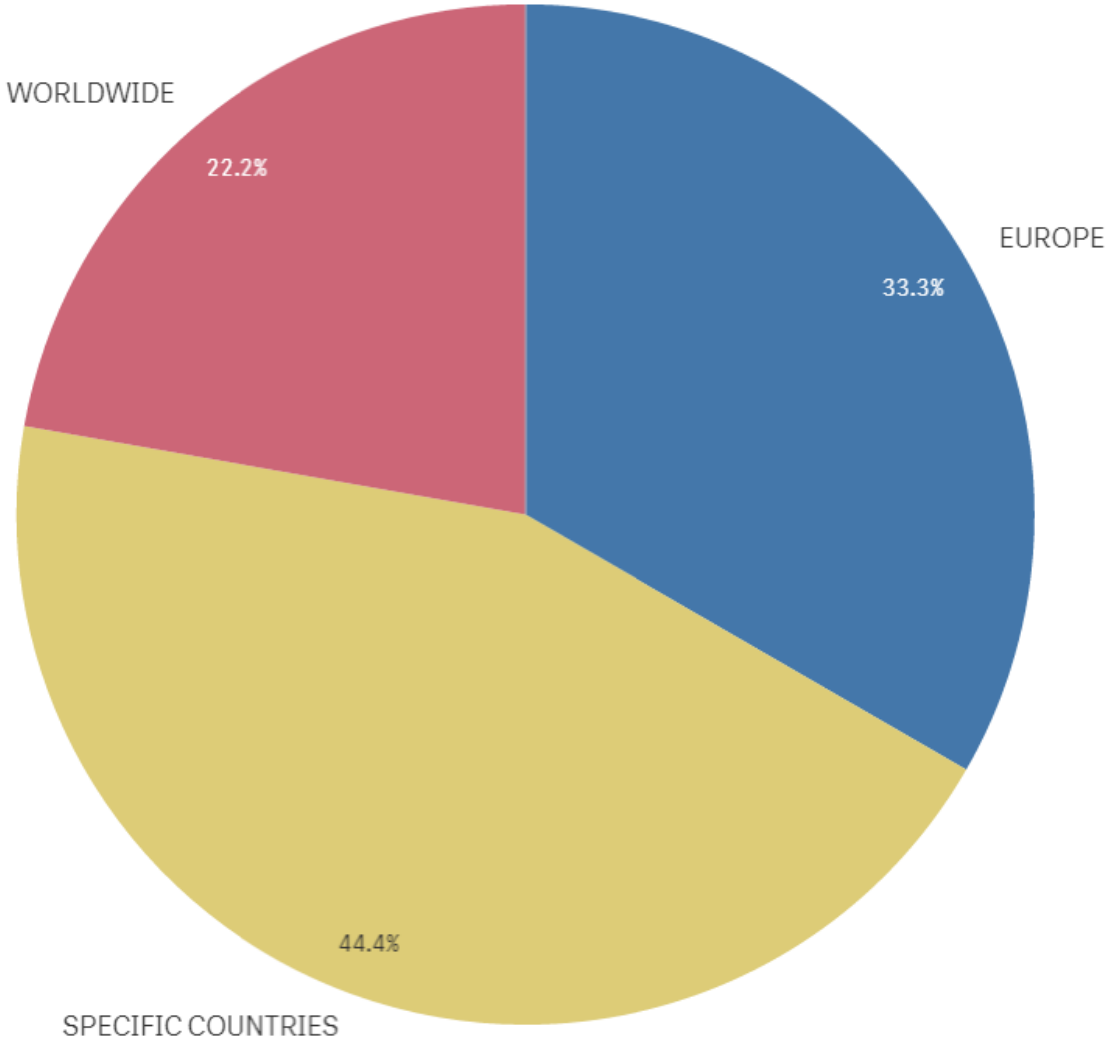

Figure 12: KPI 1.6 (Offer): course on-site provided – UMBRELLA ORG. sample

With respect to Umbrella organisations, **Figure 12** indicates that of those respondents providing courses on site 44% did so in specific countries, 22% delivered EU wide courses on site, with 33% providing worldwide on site provision.

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7.1.5. EQF OFFERED

VET providers were aked to indicate the different European Qualification Framework (EQF)[32] levels (from 3-8) at which they offered courses.

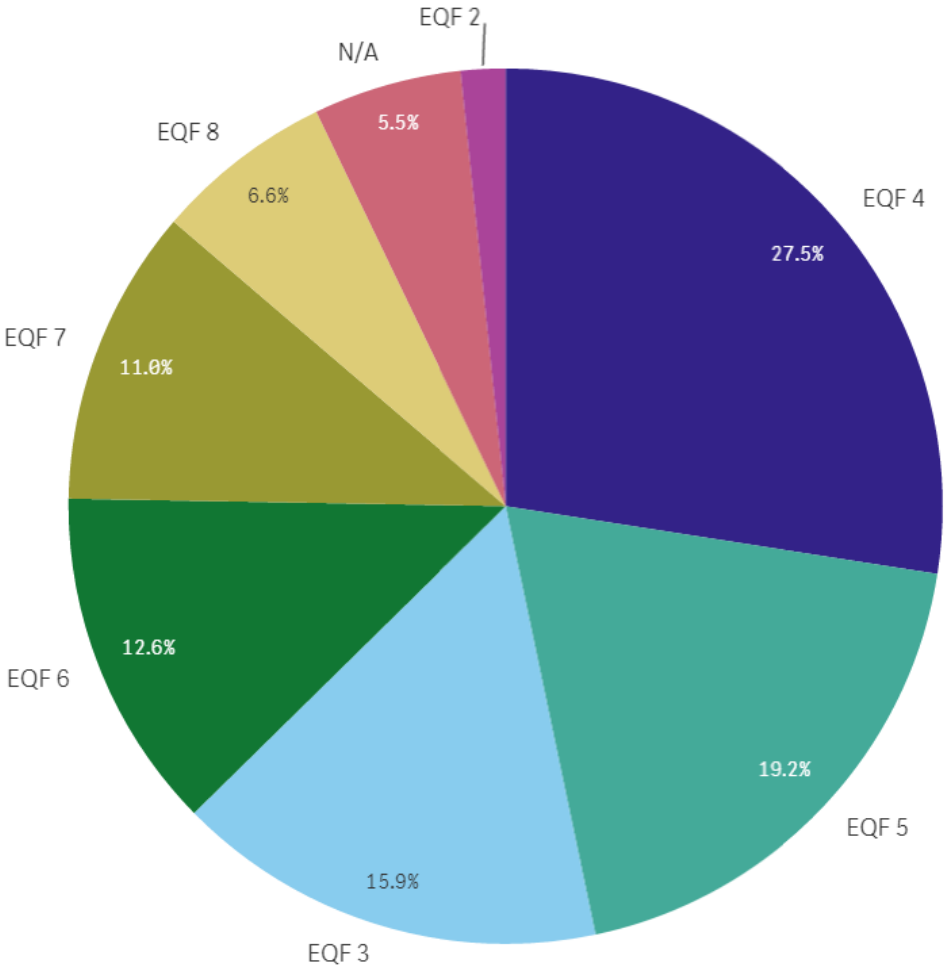

Figure 13: KPI 1.9 (Offer): EQF course level provided – Overall sample

Analysing all responses including those organisations providing courses at a range of different EQF levels points to a relatively broad spread of provision by level as outlined in **Figure 13**, with 27.5% of all responses at EQF level 4, followed by the EQF level 5 (19.2%), EQF level 3 (15.9%), EQF level 6(12.6%) and EQF level 7 accounting for 11% of all responses.

[32] https://ec.europa.eu/ploteus/en/content/descriptors-page

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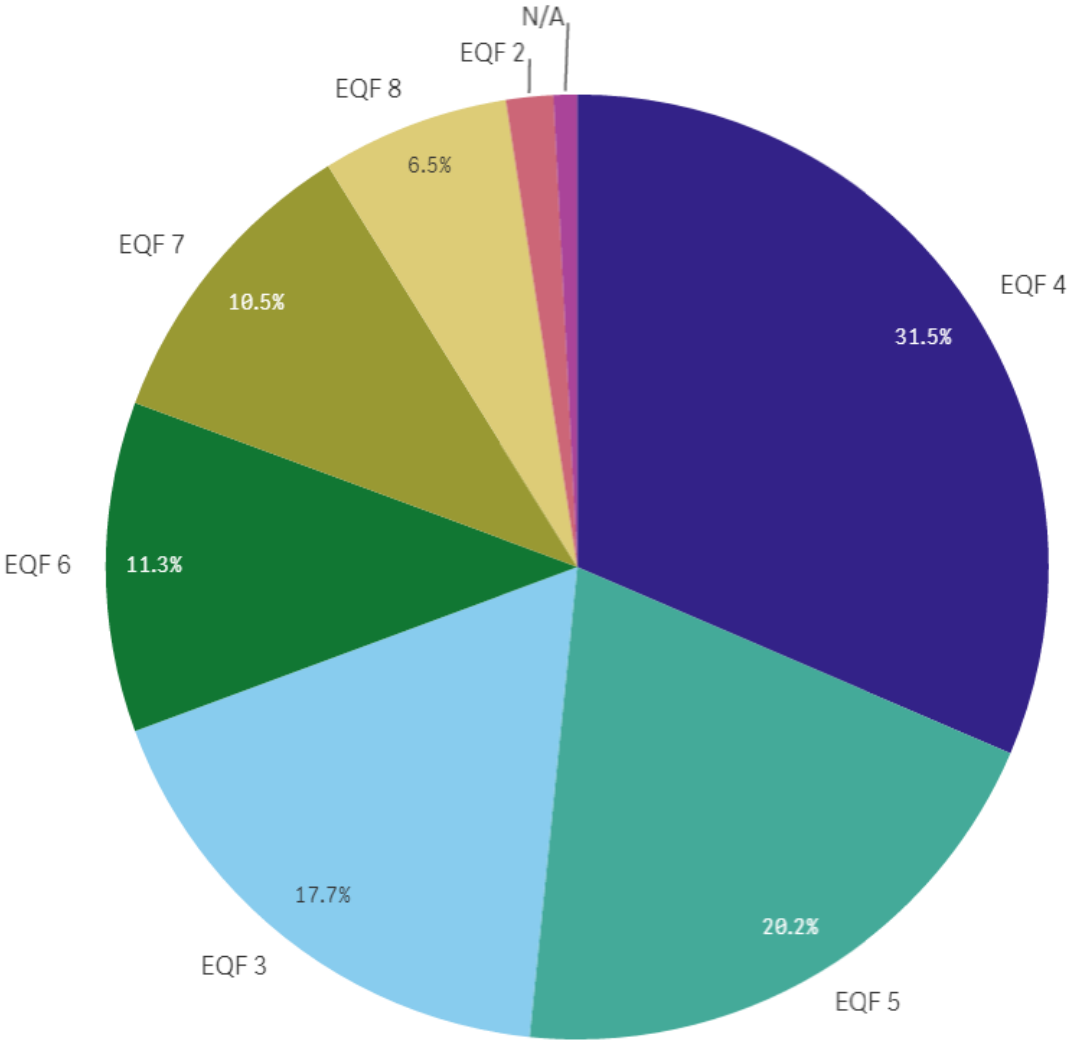

Figure 14: KPI 1.9 (Offer): EQF course level provided – VET sample

The same analysis but just for vocational training (**Figure 14**) schools indicates that EQF level 4 is again the most common level of provision (31.5%), with the profile of provison at other levels broadly following the same pattern as that for all VET stakeholders, with the figures for EQF levels 5, 3, 6, 7 and 8 being 20.2%, 17.7%, 11.3%, 10.5% and 6.5% of responses respectively. Again, the number of responses relating to EQF 2 level is insignificant.

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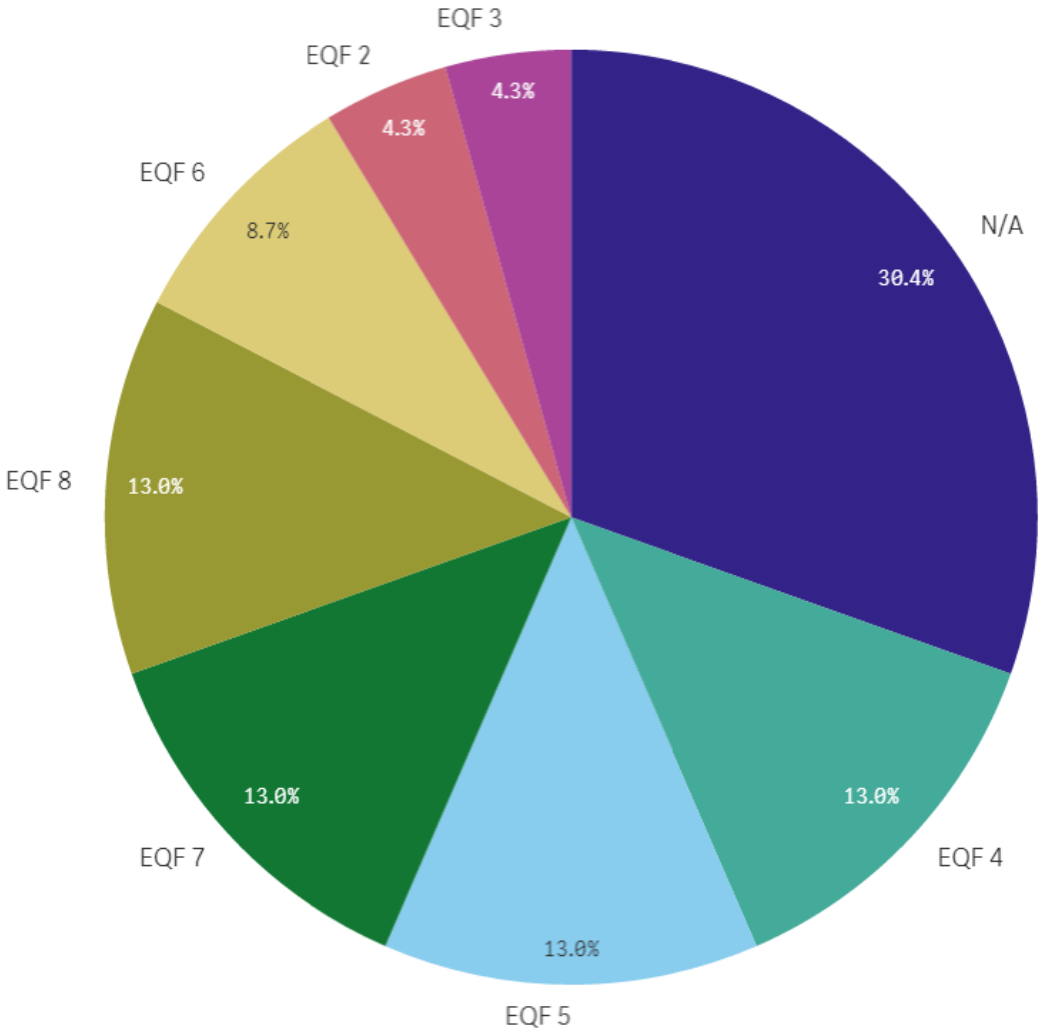

Figure 15: KPI 1.9 (Offer): EQF course level provided – INSTITUTE sample

The same analysis but for Institutes (**Figure 15**) indicates that for 30% of respondents EQF level is not applicabale (N/A), with responses for EQF levels 4, 5, 7 and 8 at a 13% each respectively. The incidence of provision at EQF levels 2 and 3 is somewhat lower (4% in each case) and EQF level 6 is at 9%

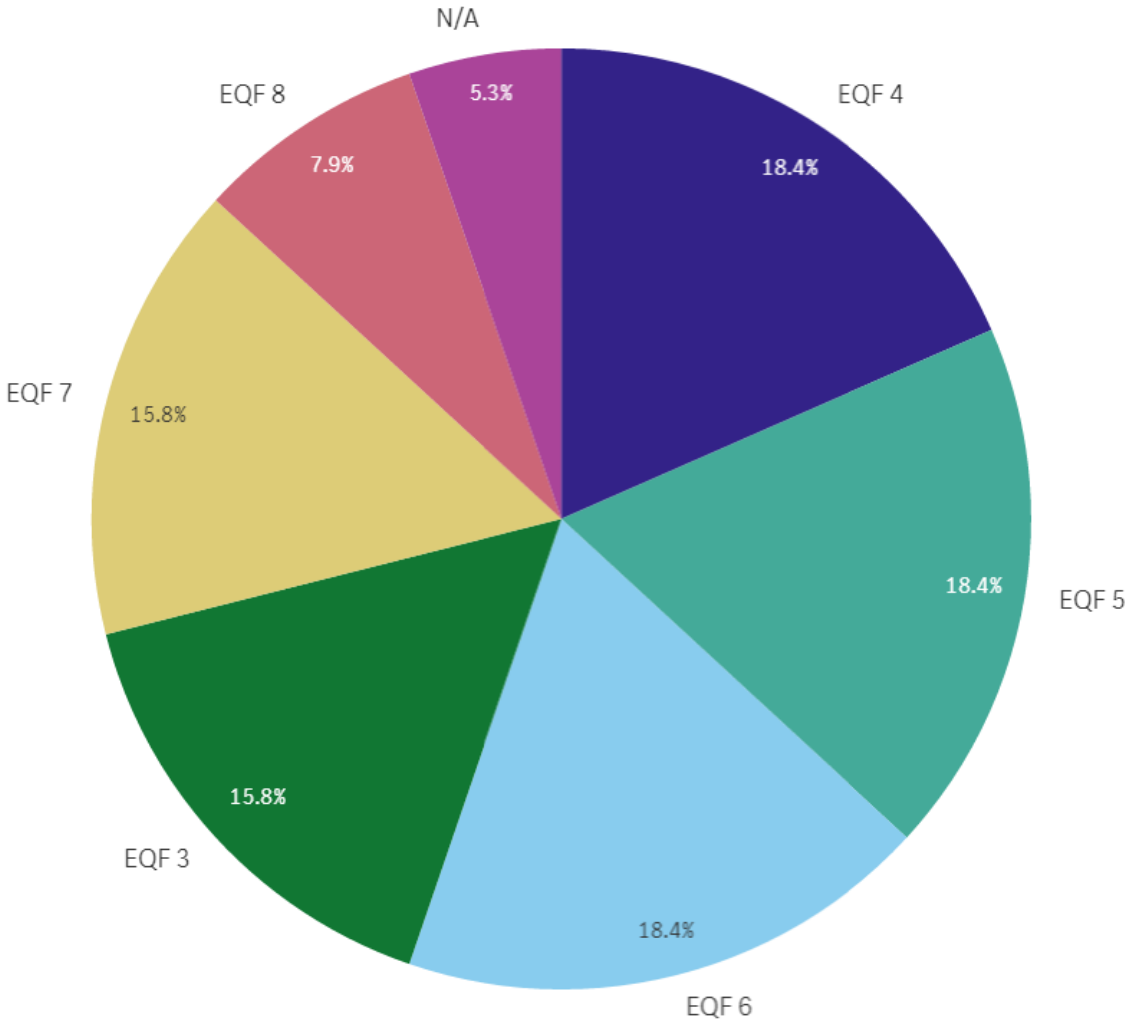

Figure 16: KPI 1.9 (Offer): EQF course level provided – PRIVATE COMPANY sample

The profile of provision by private companies is outlined in **Figure 16**. This indicates that the bulk of provision is at EQF levels 4, 5 and 6, accounting for 18% of responses in each case, with EQF levels 3 and 7 accounting for a further 16% in each case. A somewhat lower incidence of provision at level EQF8 is evident (8%).

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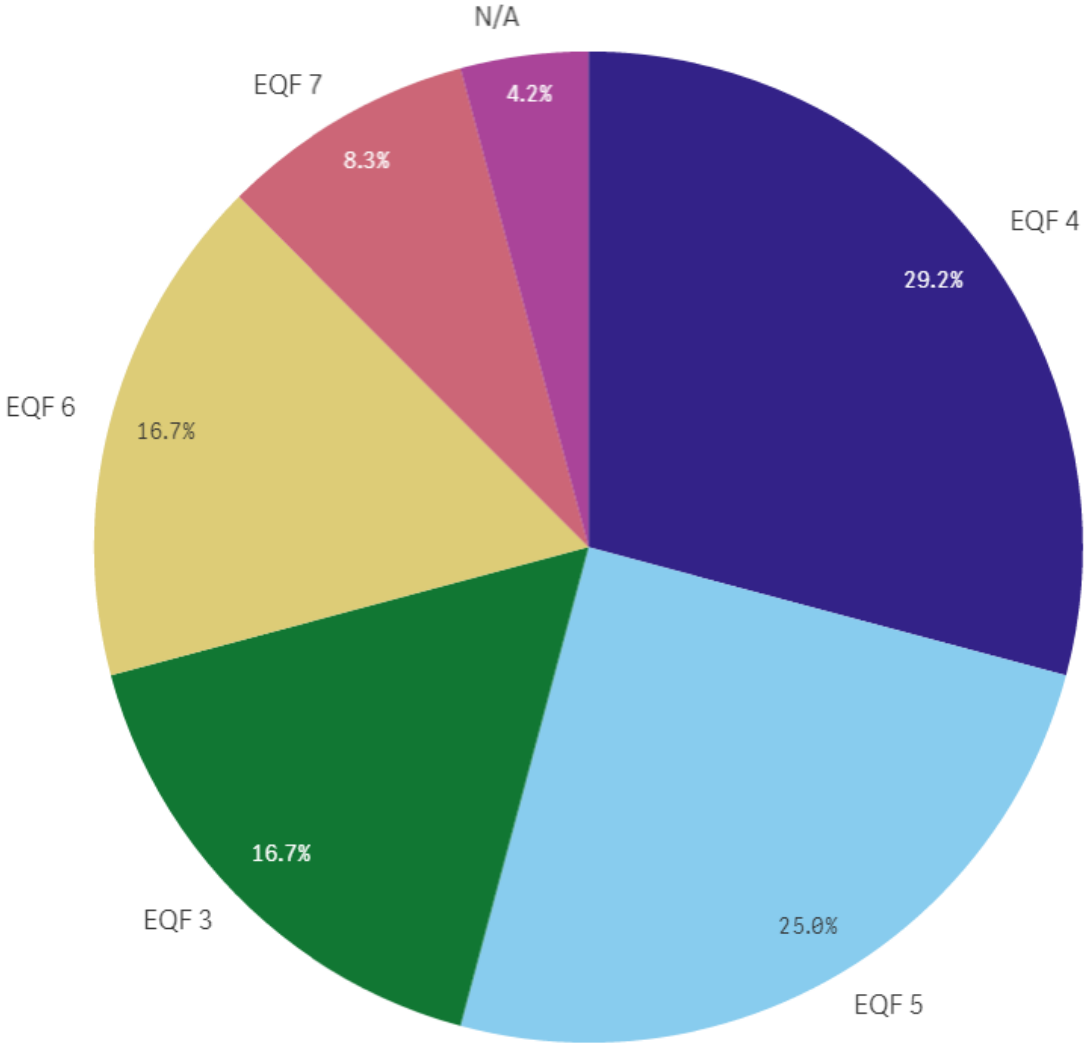

Figure 17: KPI 1.9 (Offer): EQF course level provided – UMBRELLA ORG. sample

With respect to Umbrella organisations, **Figure 17** indicates that EQF level 4 is the most common level of provision (29% of all responses) followed closely by EQF level 5 (25%) and a significantly lower incidence at EQF level 3 and 6 at 17% in each case.

7.1.6. DIFFERENCE BETWEEN DEMAND AND OFFER

The coverage of the European countries during the investigation was substantially adequate even if the redemption was not considered enough. As shown in **Figure 18**, some countries responded more actively than others and the distribution between "Demand" and "Offer" is unbalanced. In the next project activities, a strong involvement and dissemination actions must be put in place to allow greater redemption and uniformity of responses between countries for the stakeholders of the "Demand" and the "Offer".

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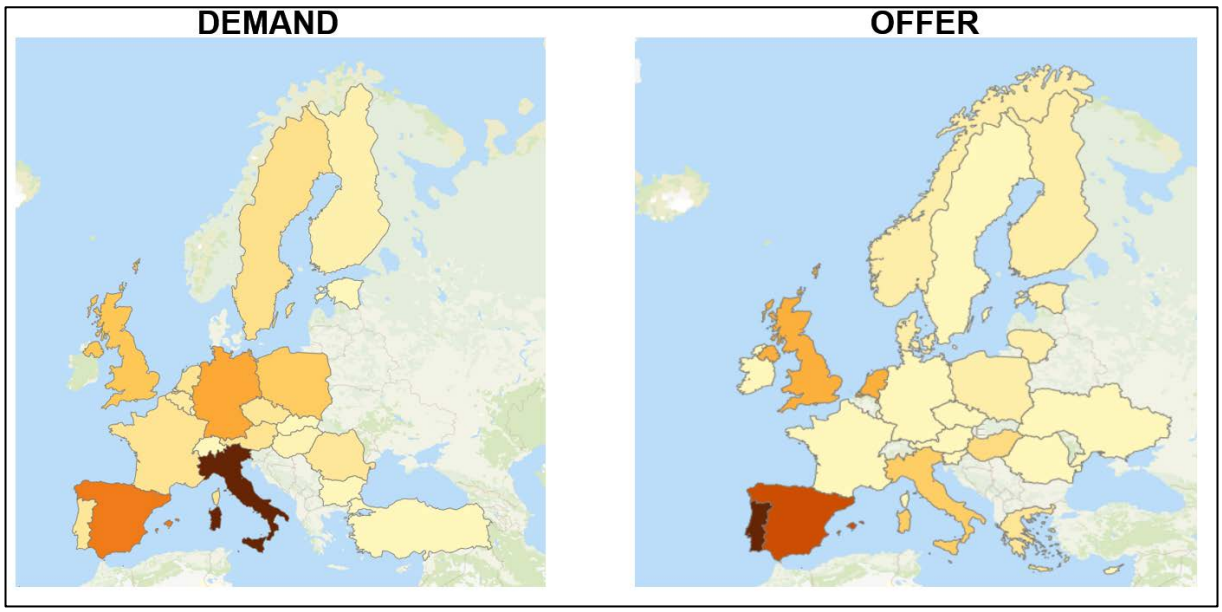

Figure 18: Geographical distribution in EU between engaged stakeholders into the 2 surveys

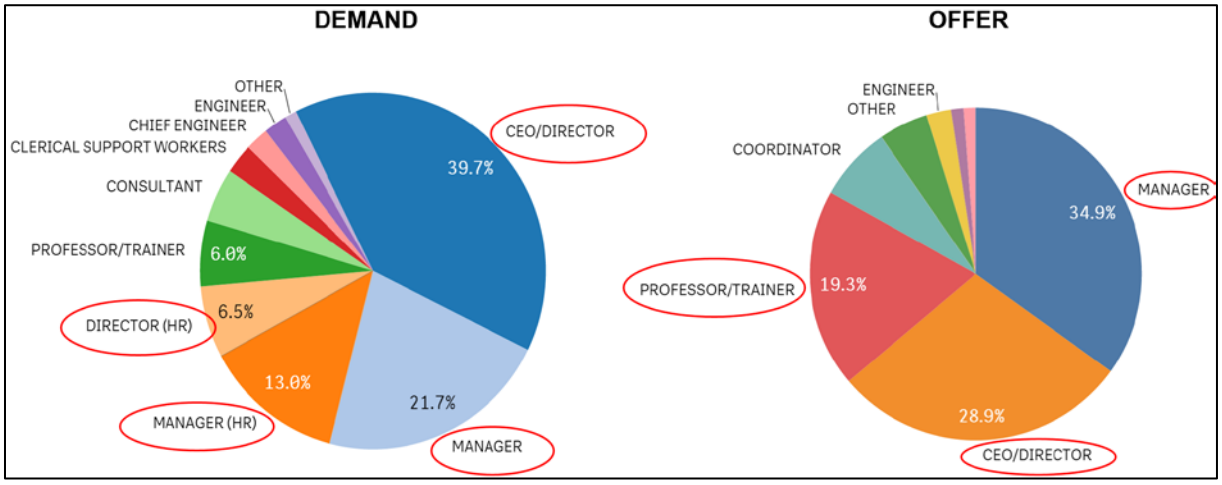

Figure 19: stakeholders job roles

In **Figure 19** is possible to see that the main decision maker in both Demand and Offer survey are predominant in replies. In further stakeholders interactions it is important to maintain an high percentage of respondents according to this picture.

6.2 DRIVERS OF CHANGE

For each Driver of Change, respondents were asked to comment on two key issues:

- **Importance**: The relative importance of each Driver of Change for the respondents' particular business using a ranking from 0 to 5

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- 0 = not applicable
- 1 = not important
- 2 = slightly important
- 3 = moderately Important
- 4 = important
- 5 = very important

- **Urgency**: Respondents were asked to identify the relative importance of the impact of each specific Driver of Change over the periods up to 2020, 2025 and 2030
  - by 2020: 5 = very urgent
  - by 2025, 3 = urgent
  - by 2030 and later, 1 = not urgent

6.2.1 IMPORTANCE OF DRIVERS OF CHANGE GROUPS

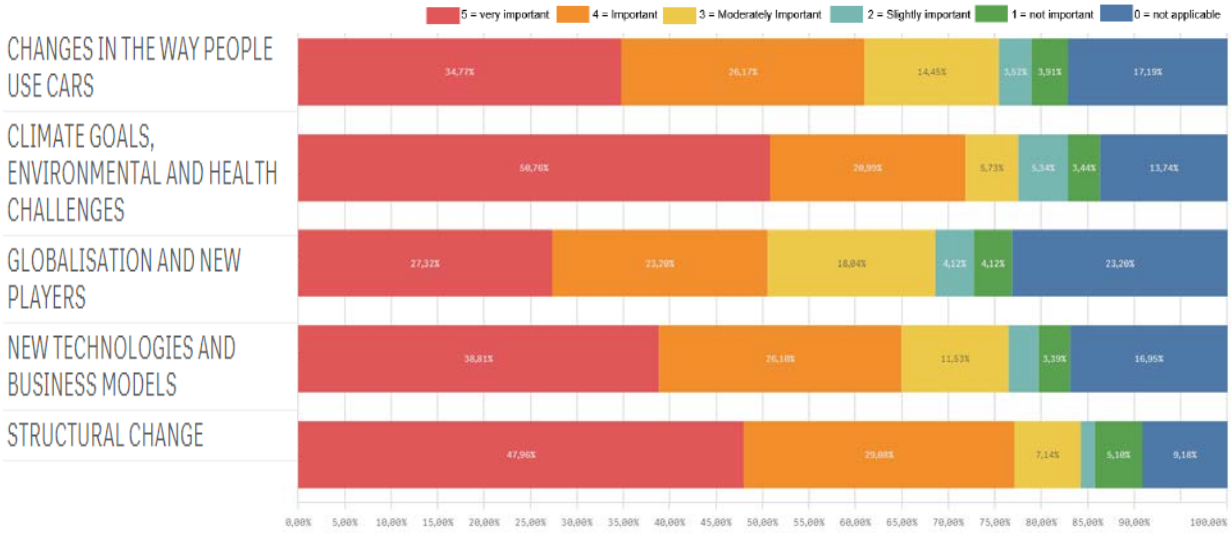

Figure 20: KPI 2.1 (Offer): DRIVERS OF CHANGE Groups: IMPORTANCE – Overall sample

Figure 20 provides an overview of DRIVERS of Change 'macro' Groups based on importance from the perspective of the offer. The figure indicates that the Drivers of Change "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES" was most likely to be identified as 'most important' (score 5) with 51% of respondents indicating this was the case, followed by "STRUCTURAL CHANGE" (48%). "NEW TECHNOLOGIES AND BUSINESS MODELS" and "CHANGES IN THE WAY PEOPLE USE CARS" were ranked third and fourth on this basis at 39% and 35% respectively. Again, based on this analysis, the Driver of Change "GLOBALISATION AND NEW PLAYERS" was the least important at 28%.

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Figure 21: KPI 2.1 (Offer): DRIVERS OF CHANGE Groups: IMPORTANCE – VET sample

Figure 21 outlines the same analysis, but based solely on VET respondents. The analysis points to a similar pattern to that of the overall sample, with "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES" again the most frequently cited driver of change (50%). This was followed by"STRUCTURAL CHANGE" (45%) and "NEW TECHNOLOGIES AND BUSINESS MODELS" (40%). "CHANGES IN THE WAY PEOPLE USE CARS" and "GLOBALISATION AND NEW PLAYERS" were ranked fourth and the fifth based on this analysis, with 26% and 22% of respondents citing each of these drivers of change as most important.

Figure 22: KPI 2.1 (Offer): DRIVERS OF CHANGE Groups: IMPORTANCE – INSTITUTE sample

Figure 22 provides a summary of responses from the perspective of Institutes with "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES", again the most frequently cited as 'most important

(58%). This was followed by "STRUCTURAL CHANGE" (53%). The analysis indicates that "CHANGES IN THE WAY PEOPLE USE CARS" is also considered an important driver of change with 46% citing this as 'most important'. Based on this criteria "NEW TECHNOLOGIES AND BUSINESS MODELS" and "GLOBALISATION AND NEW TRENDS" were ranked fourth and the fifth, with close to 40% of respondents citing each driver as 'most important'.

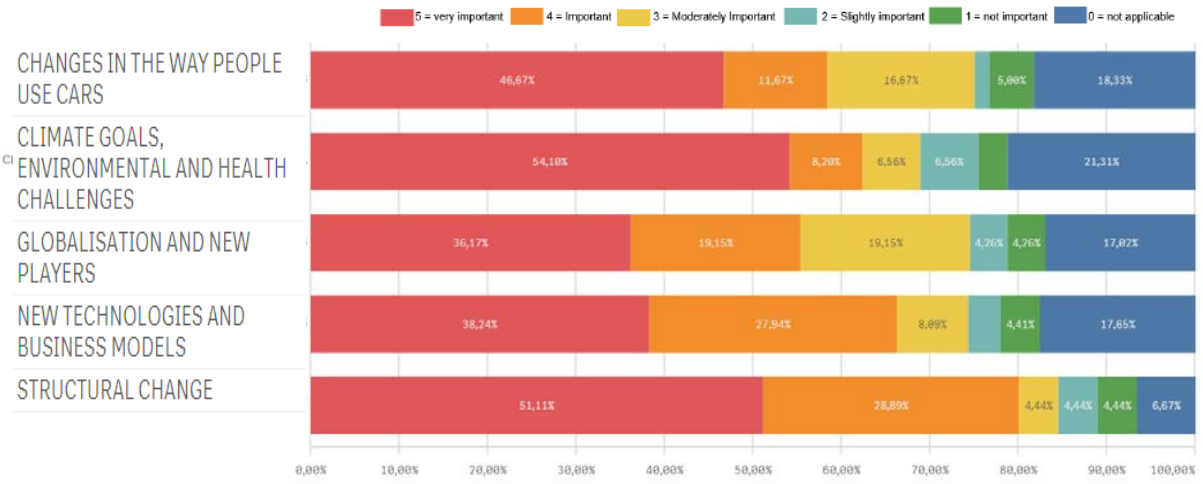

Figure 23: KPI 2.1 (Offer): DRIVERS OF CHANGE Groups: IMPORTANCE – PRIVATE COMPANY sample

Figure 23 outlines the same analysis but from the perspective of private companies. The analysis points to a similar pattern to those of Institutes, as outlined in the previous **Figure 20**.

Figure 24: KPI 2.1 (Offer): DRIVERS OF CHANGE Groups: IMPORTANCE – UMBRELLA ORG. sample

Figure 24 summarises survey responses from the perspective of umbrella organisations. The analysis indicates that based on the proportion of respondents citing each driver of change as 'most important' "STRUCTURAL CHANGES" is ranked first with 71% of respondents scoring this Driver of Change as 5. Ranked second is "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES" (59%) followed by

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"NEW TECHNOLOGIES AND BUSINESS MODELS" (48%) and "CHANGES IN THE WAY PEOPLE USE CARS" (42%). Most respondents to the survey indicated "GLOBALISATION AND NEW TRENDS" was the least important Driver of Change, (29% citing this as 'most important') .

6.2.2 IMPORTANCE: DIFFERENCE BETWEEN DEMAND AND OFFER

To map the gap the analysis is presented with a comparison of the main view of the five macro Drivers of Change with reference to the IMPORTANCE and URGENCY, using also the PRIORITY INDEX[33]

Figure 25: DoC IMPORTANCE comparison between the 2 surveys

The relative importance attached to different Drivers of Change by respondents to both surveys (demand & offer) were quite similar in many respects in **Figure 25**. 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.

[33] *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*

6.2.3 URGENCY OF DRIVERS OF CHANGE GROUPS

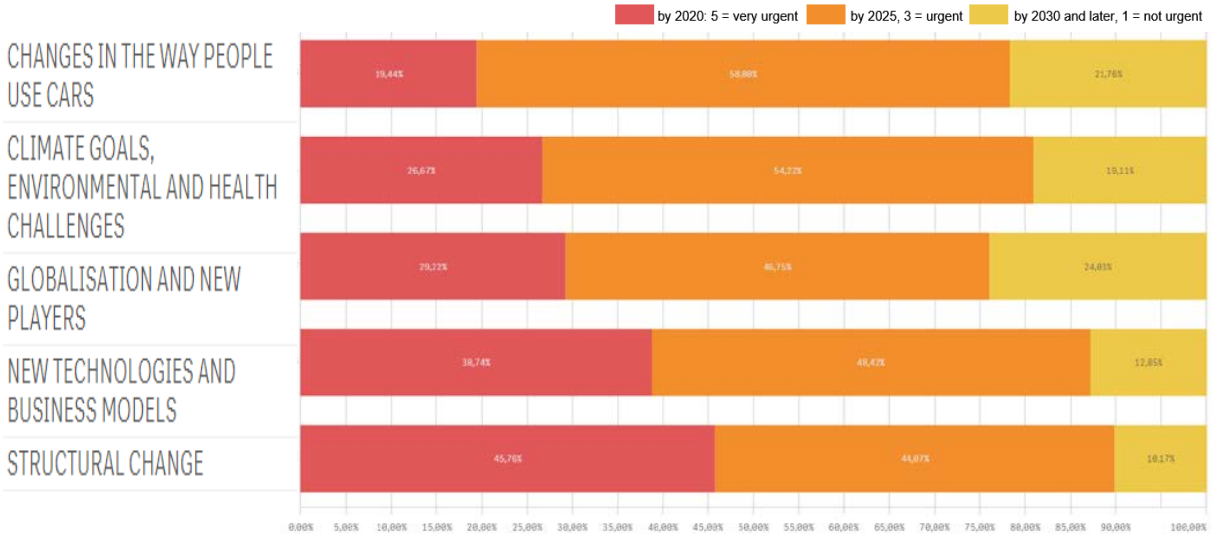

Figure 26: KPI 2.2 (Offer): DRIVERS OF CHANGE Groups: URGENCY – Overall sample

Figure 26 sets out an analysis of the urgency of Drivers of Change from the perspective of the provision 'offer'. "STRUCTURAL CHANGES" was the Driver of Change most likely to be ranked first in terms of the level of urgency with 46% responses indicating this will impact on the need for changes in provision to meet changing skill requirements in the sector by 2020 (very urgent). Ranked second on this basis was "NEW TECHNOLOGIES AND BUSINESS MODELS"(scored very urgent by 39% of respondents) followed by "GLOBALISATION AND NEW PLAYERS" (29%); "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES" (27%) and "CHANGES IN THE WAY PEOPLE USE CARS" (19%).

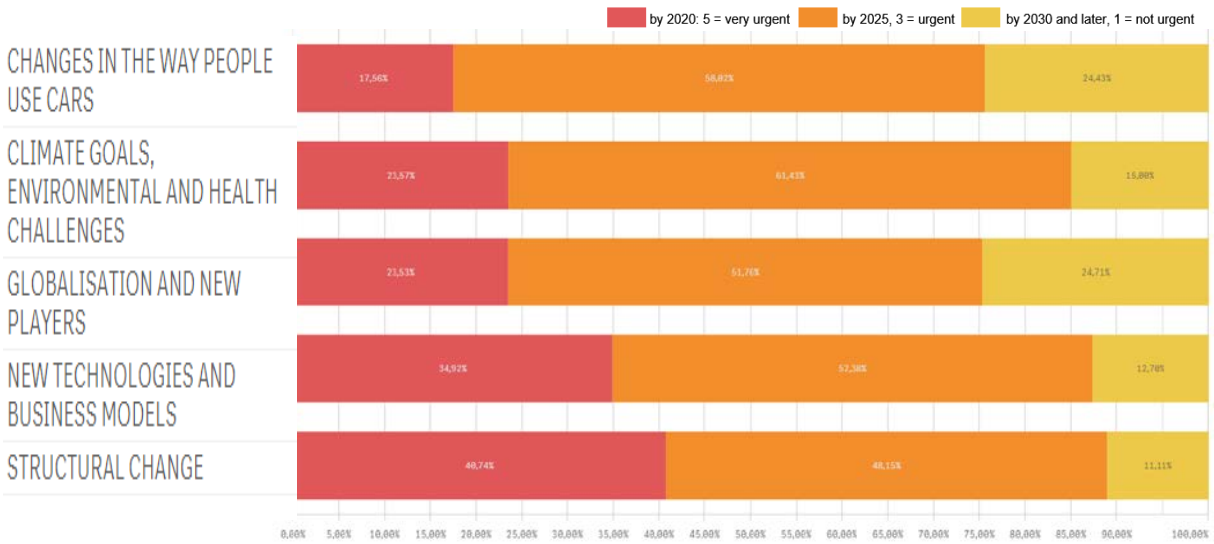

Figure 27: KPI 2.2 (Offer): DRIVERS OF CHANGE Groups: URGENCY – VET sample

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Figure 27 sets out the same analysis but from the perspective of VET providers. This analysis almost mirrors the position for the overall sample. The only slight differences being that "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES" (24%) and "GLOBALISATION AND NEW PLAYERS"were ranked third and fourth respectively d by (24%).

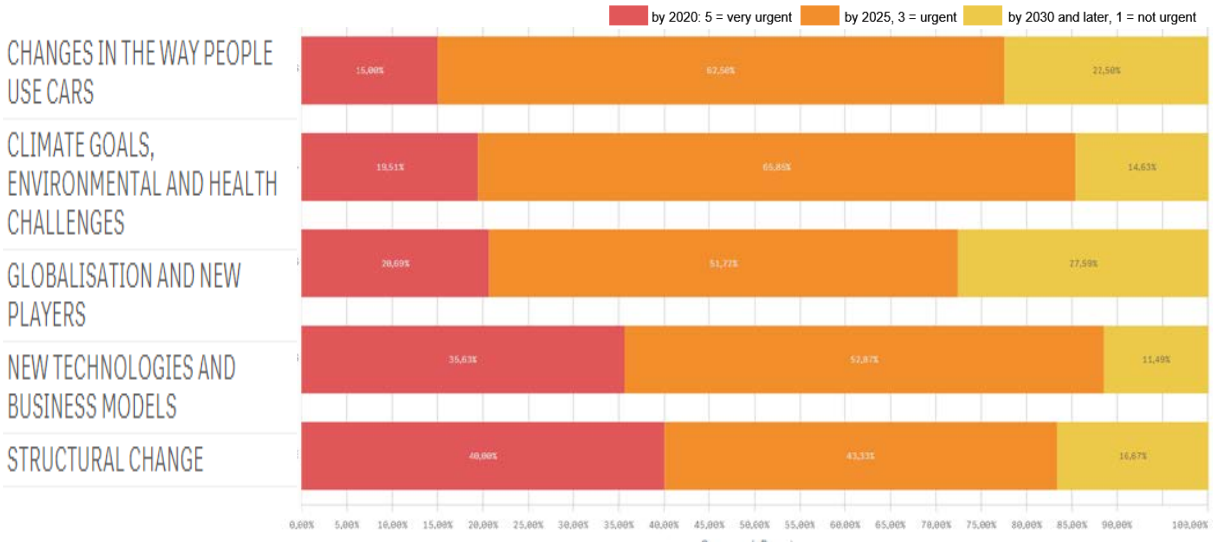

Figure 28: KPI 2.2 (Offer): DRIVERS OF CHANGE Groups: URGENCY – INSTITUTE sample

Figure 28 outlines the same analysis but for Institutes. The analysis points to a similar picture to that of the overall sample: "STRUCTURAL CHANGES" ranked first in terms of level of urgency (40% respondents indicating this is 'very urgent') , followed by "NEW TECHNOLOGIES AND BUSINESS MODELS" (36%) and the "GLOBALISATION AND NEW PLAYERS", at third (21%). The respective proportions for "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES" and "CHANGES IN THE WAY PEOPLE USE CARS" were 20% and 15%.

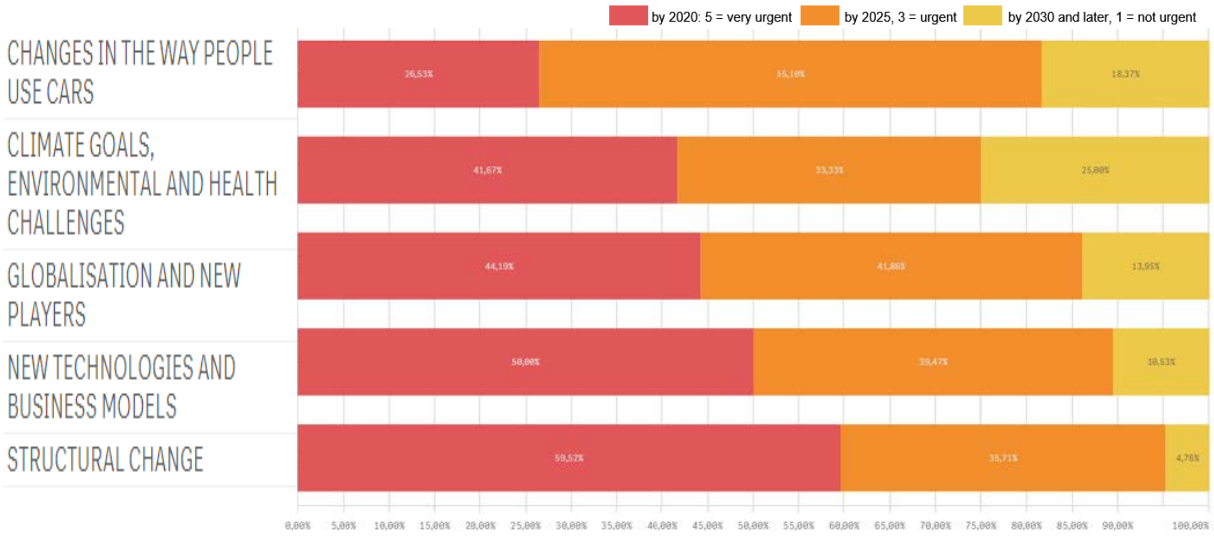

Figure 29: KPI 2.2 (Offer): DRIVERS OF CHANGE Groups: URGENCY – PRIVATE COMPANY sample

Responses of private companies (**Figure 29**) reflect those of institutes in terms of the ranking of Drivers of Change based on relative urgency but vary in terms of the actual proportion of respondents identifying each respective Driver of Change as 'very urgent'. "STRUCTURAL CHANGES" are ranked first in terms of level of urgency with 60% responses assigned as very urgent, followed by "NEW TECHNOLOGIES AND BUSINESS MODELS"(50%). "GLOBALISATION AND NEW PLAYERS", third (44%) followed by "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES" (42%) and "CHANGES IN THE WAY PEOPLE USE CARS" (27%).

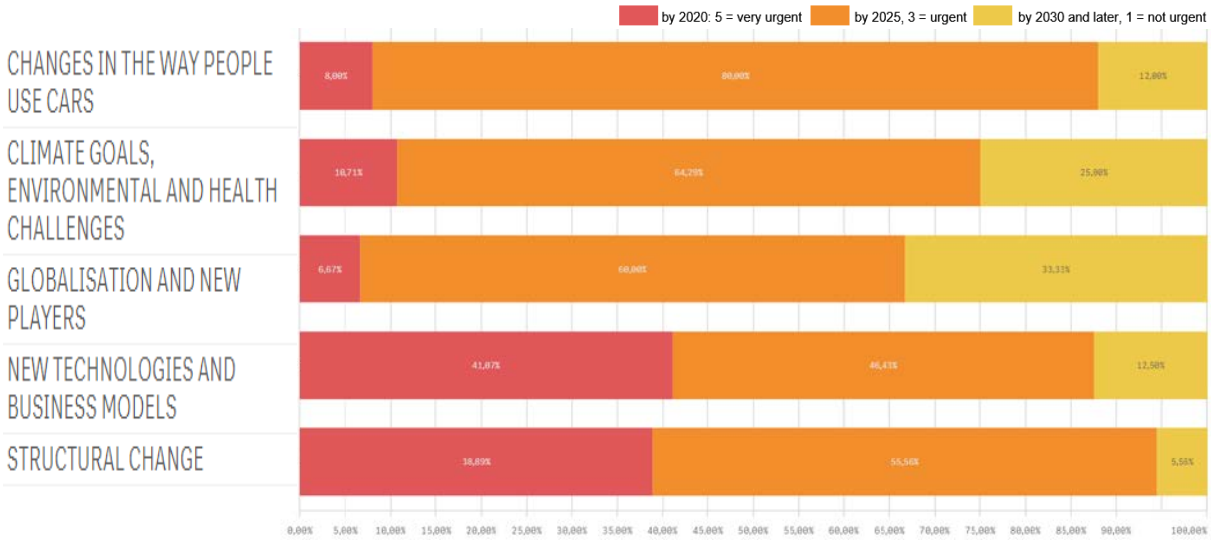

Figure 30: KPI 2.2 (Offer): DRIVERS OF CHANGE Groups: URGENCY – UMBRELLA ORG. sample

The responses of umbrella organisations are outlined in **Figure 30**. In this case the "NEW TECHNOLOGIES AND BUSINESS MODELS" are ranked first based on the proportion inducating this as the most urgent Driver of Change (41% of respondents), followed by the "STRUCTUREAL CHANGES" (39%). For all drivers of change the most likely time period by which this will impact on the need for changes in provision to meet changing skill requirements in the sector is by 2025.

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6.2.4 URGENCY: DIFFERENCE BETWEEN DEMAND AND OFFER

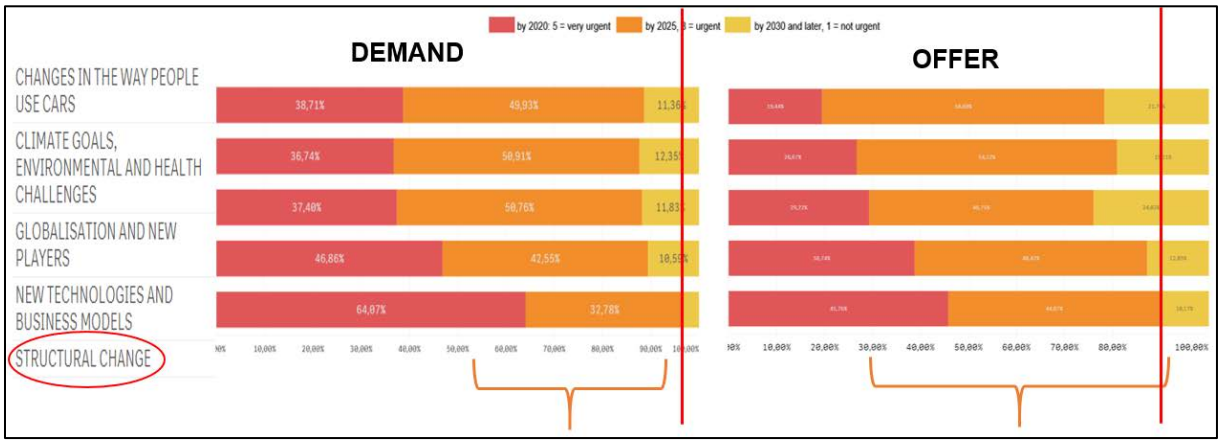

Figure 31: DoC URGENCY comparison between the 2 surveys

Even if the ranking between Demand and Offer is similar in terms of position in **Figure 31**, 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.

6.2.5 NEW TECHNOLOGIES AND BUSINESS MODELS

These developments will lead to changes in the production and capability of vehicles. They will require substantial funding and/or financial support. Public authorities will have a key role to play in facilitating the roll-out of automated driving and alternative powertrains by putting in place relevant policies that will allow the sector to accommodate new requirements in a timely manner, together with the necessary financing frameworks to support these changes.

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

Individual Drivers of Change in this category are:

- **Connected and Automated Driving (CAD), Advanced Driver Assistance Systems (ADAS)**

These are aspects related to the assistance and automation of the driving activities to reduce road fatalities by minimising human errors, providing new services and accessibility, improving traffic flows and moving a vehicle without active driver interventions

- **Electrification**

  It is clear that running out of crude oil and the need for CO2 global reduction are both critical issues in Europe. Electrification of the whole powertrain is a possible strategy to tackle this issue.

  Electrification has been identified as one of the possible solutions to help achieve CO2 global reduction and improve local air quality.

- **Handling of / access to, vehicle data**

  Increasing technology inside a vehicle and the relative necessity to be connected drive the needs to manage and access huge quantities of data quickly. Big data and analytics will allow players to optimise vehicle usage and forecast maintenance requirements (predictive maintenance).

- **Advanced manufacturing, digitalisation and robotization of the manufacturing process**

  Firms in the automotive sector are facing constant developments in the area of advanced manufacturing and integrating the results of technological research into manufacturing processes. Moreover, Manufacturing 4.0 can create efficiency and reduce (indirect) costs.

- **Alternative powertrains:**

  The variation from internal combustion to a CO2 neutral mobility is directly connected to changes in powertrains.

- **New communications technologies:**

  In the near future the vehicle will be connected, with digital technologies changing the way data is transferred and utilised. These new communication technologies have a key strategic importance in relation to changes in the sector.

- **3D printing:**

  It is a technology that can lead to a reduction in the costs of production as well as a reduction in defects and will also have an impact on jobs and skill requirements. Moreover, it is useful for rapid prototyping and advanced manufacturing and enables prototypes to be 'moved' between different players within the supply chain very quickly and efficiently.

- **New / advanced materials**

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Modern car parts are increasingly made of lighter materials and these new / advanced materials are driving the strategies for future evolution in terms of product, design and performance.

- **OEM products standardisation and plug & play**

  The car assembly process will be performed by robots with higher AI and the tendency will be to use ready-built and plug & play parts to make activities more efficient and faster; moreover, OEMs will improve process and cost efficiency and might be able to set the standards in a market where brand attractiveness will diminish (due to the shift between car-owner to car-user). Common online platforms might connect supply and demand globally to increase the efficiency of players across the supply chain.

6.2.5.1 New Technologies and Business Models: Importance

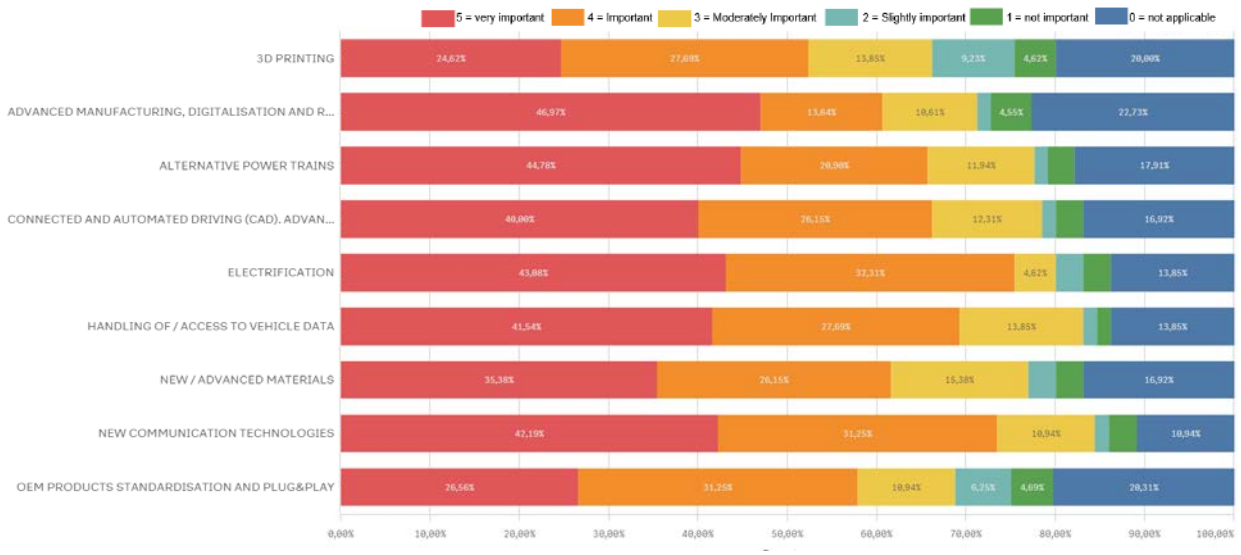

Figure 32: KPI 2.3 (Offer) Drivers of Change – Group NEW TECHNOLOGIES AND BUSINESS MODELS – IMPORTANCE – Overall sample

Figure 32 sets out analysis of the overall sample of respondents based on importance with respect to the provision offer related to the Driver of Change "NEW TECHNOLOGIES AND BUSINESS MODEL GROUP". "ADVANCED MANUFACTURING, DIGITALISATION AND ROBOTIZATION OF THE MANUFACTURING PROCESS", "ALTERNATIVE POWERTRAINS", and "ELECTRIFICATION" are ranked as the TOP3 specific Drivers of Change based on the proportion of respondents identifying these as 'most important' (Score of 5) . If the 'very important' (score of 5) and 'important' (score of 4) scores are

combined, “ELECTRIFICATION”, ”NEW COMMUNICATION TECHNOLOGIES”, and “HANDLING OF / ACCESS TO VEHICLE DATA” are ranked as the TOP3 drivers. The analysis points to the conclusion that that currently the greatest demand for support relates to the above Drivers of Change.

Relatively low importance for support based on the relative importance attached to each Driver of Change is evident in relation to OEM PRODUCTS STANDARDISATION AND PLUG&PLAY” and “3D PRINTING”..

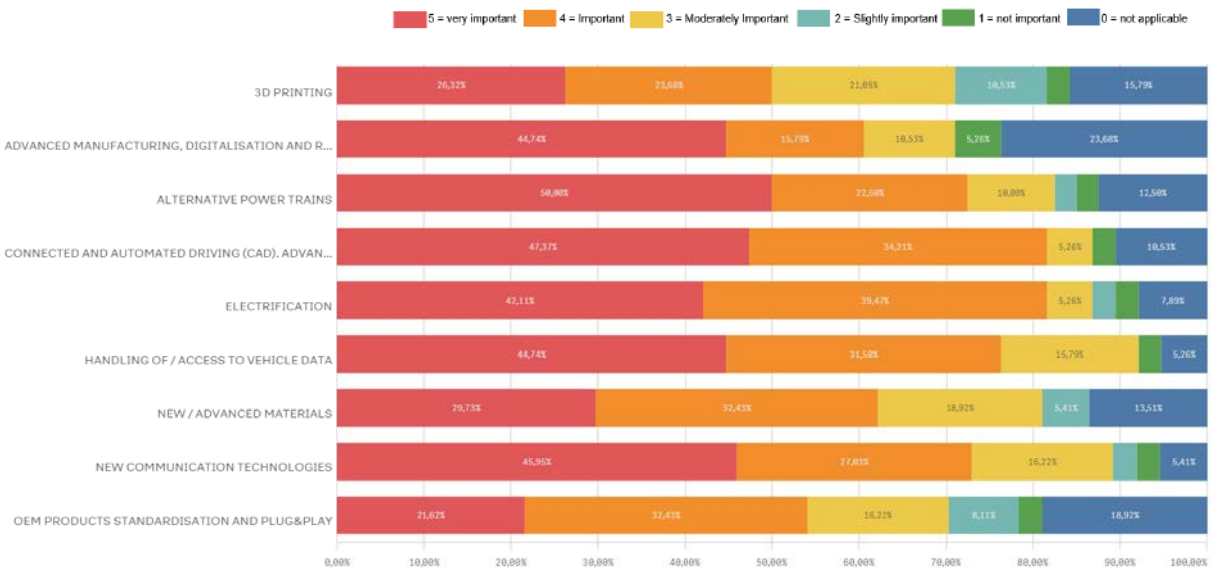

Figure 33: KPI 2.3 (Offer) Drivers of Change – Group NEW TECHNOLOGIES AND BUSINESS MODELS – IMPORTANCE – VET sample

Figure 33 sets out analysis of the VET sample of respondents based on importance with respect to the of provision offer related to the Driver of Change “NEW TECHNOLOGIES AND BUSINESS MODEL GROUP”. Based on the proportion of respondents identifying each specific Driver of Change as ‘very important’ (score of 5) or ‘important’ (score of 4), the greatest demand for support is evident in relation to “CONNECTED AND AUTOMATED DRIVING” and “ELECTRIFICATION” followed by “HANDLING OF / ACCESS TO VEHICLE DATA” and “ALTERNATIVE POWERTRAINS”. These are all ICT related skills. On this basis, the least demand for support is evident in relation to “3D PRINTING” and “OEM PRODUCTS STANDARDISATION AND PLUG&PLAY”.

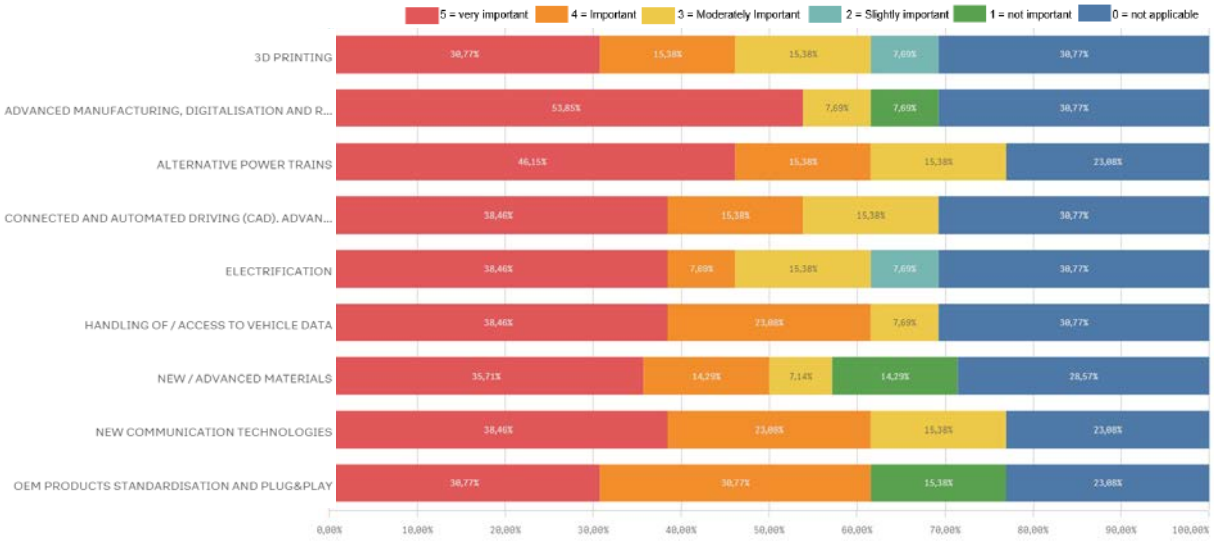

Figure 34: KPI 2.3 (Offer) Drivers of Change – Group NEW TECHNOLOGIES AND BUSINESS MODELS – IMPORTANCE – INSTITUTE sample

Figure 34 sets out the same analysis but in relation to responses from Institutes. This sample includes research institutes, accreditation, certification or qualification bodies. In terms of those respondents identifying each specific Driver of Change as 'very important' "ADVANCED MANUFACTURING, DIGITALISATION AND ROBOTIZATION OF THE MANUFACTURING PROCESS" is ranked first. If the scores for "very important" and "important" are combined "ALTERNATIVE POWERTRAINS", "HANDLING OF / ACCESS TO VEHICLE DATA", "NEW COMMUNICATION TECHNOLOGIES", and "OEM PRODUCTS STANDARDISATION AND PLUG&PLAY" are ranked highest, pointing to the priorities attached to specific types of support by this group of respondents

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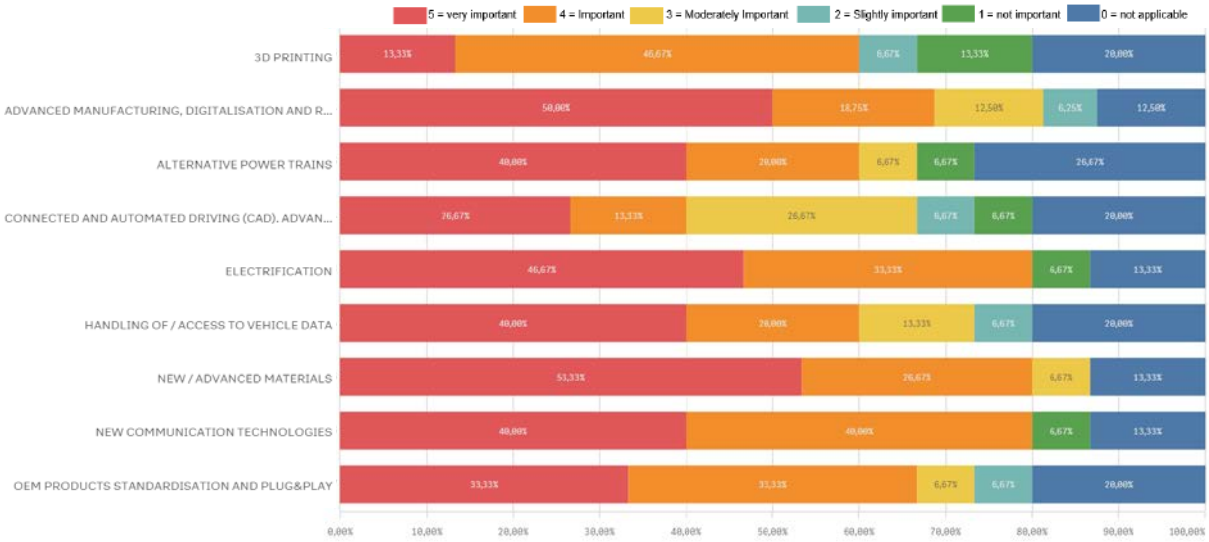

Figure 35: KPI 2.3 (Offer) Drivers of Change – Group NEW TECHNOLOGIES AND BUSINESS MODELS – IMPORTANCE – PRIVATE COMPANY sample

The importance attached to specific Drivers of Change in terms of the impact on provision requirements identified by private companies is set out in **Figure 35**. The analysis points to a fairly broad spread of drivers likely to impact on provision, reflecting the diverse range of skills private companies support. If the scores for "very important" and "important" are combined, only "3D PRINTING" is identified as less important by comparison with other groups. "ELECTRIFICATION", "NEW COMMUNICATION TECHNOLOGIES" and "NEW / ADVANCED MATERIALS" were identified as the most important specific Drivers-of-Change on this basis.

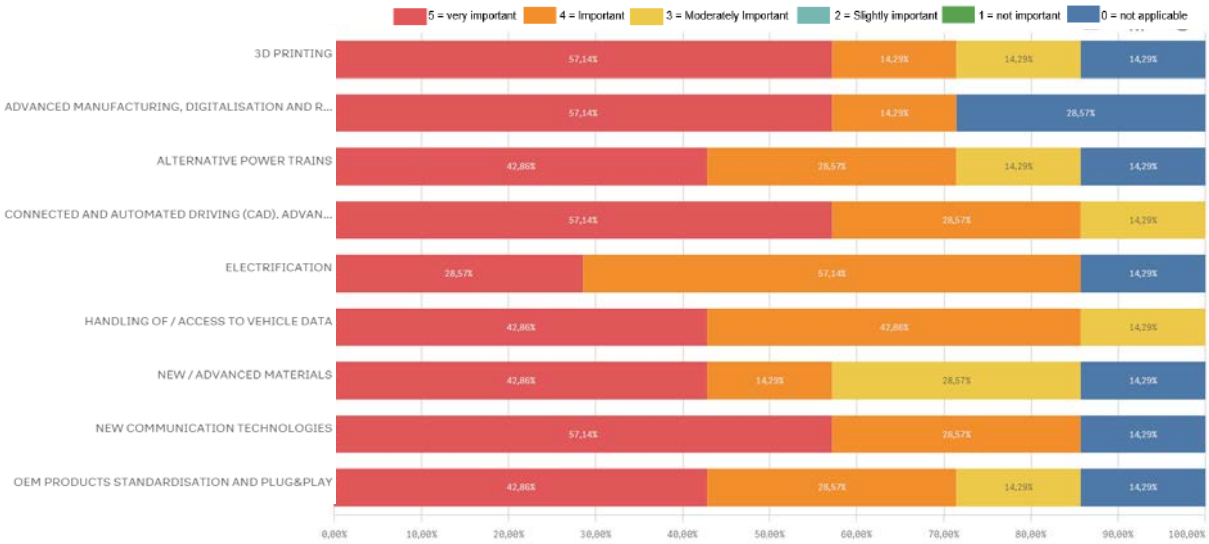

Figure 36: KPI 2.3 (Offer) Drivers of Change – Group NEW TECHNOLOGIES AND BUSINESS MODELS – IMPORTANCE – UMBRELLA ORG. sample

Figure 36 sets out the same analysis from the perspective of umbrella organisations, with patterns of response broadly similar to that of private companies. Again, if the scores for ("very important" and

"important") are combined, two major clusters of Drivers of Change in terms of importance are evident. Firstly: "CONNECTED AND AUTOMATED DRIVING", "HANDLING OF / ACCESS TO VEHICLE DATA", "NEW COMMUNICATION TECHNOLOGIES", and "ELECTRIFICATION". The second cluster comprises: "3D PRINTING", "ADVANCED MANUFACTURING, DIGITALISATION AND ROBOTIZATION OF THE MANUFACTURING PROCESS", "ALTERNATIVE POWERTRAINS" and "OEM PRODUCTS STANDARDISATION AND PLUG&PLAY".

The notable exception to the above is "NEW/ADVANCED MATERIALS", which appears to be identified as of lesser importance by umbrella organisations.

6.2.6 DIFFERENCE BETWEEN DEMAND AND OFFER

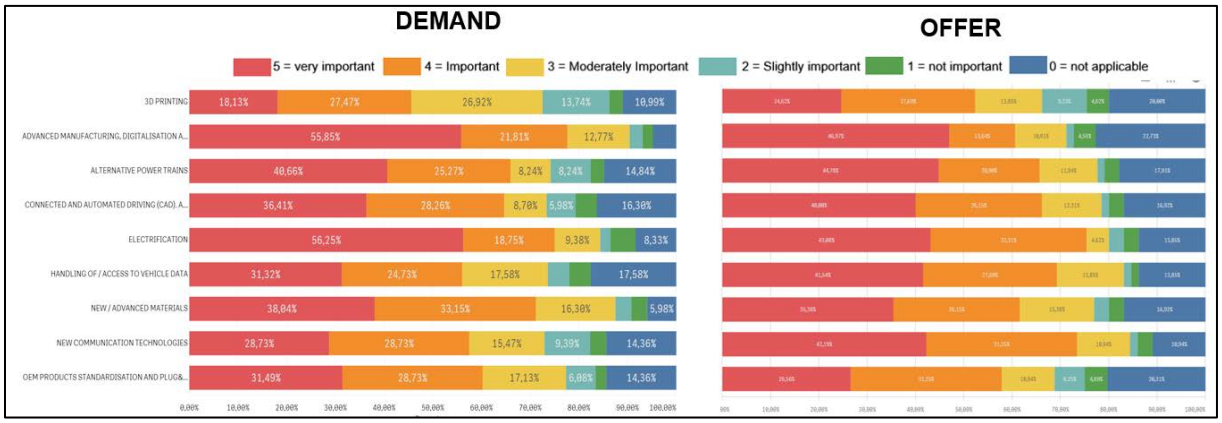

Figure 37: NEW TECHNOLOGIES AND BUSINESS MODELS - IMPORTANCE - comparison between the 2 surveys

In the Demand analysis "ADVANCED MANUFACTURING, DIGITALISATION AND ROBOTIZATION OF THE MANUFACTURING PROCESS", "ELECTRIFICATION" and "NEW ADVANCED MATERIALS" have been ranked as the TOP3 in relation to importance (Combining scores 4 and 5). This compares with "ELECTRIFICATION", "NEW COMMUNICATION TECHNOLOGIES", and "HANDLING OF / ACCESS TO VEHICLE DATA" from the perspective of the offer survey respondents , with "NEW ADVANCED MATERIALS" ranked as the third lowest and "3D PRINTING" as the lowest importance on this basis. The analysis points to a convergence of priorities in relation to "ELECTRIFICATION" in terms of perspectives from both Demand and the provision Offer, and "ADVANCED MANUFACTURING, DIGITALISATION AND ROBOTIZATION OF THE MANUFACTURING PROCESS" could be supported; while the importance attached to "NEW ADVANCED MATERIALS" and "3D PRINTING" from an 'Offer' perspective is currently low (**Figure 37**). Although, with respect to the offer survey, different stakeholders attached somewhat different levels of importance to each driver of change, nevertheless, a clear trend highlighting the importance of ICT skills is evident.

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6.2.6.1 New Technologies and Business Models: Urgency

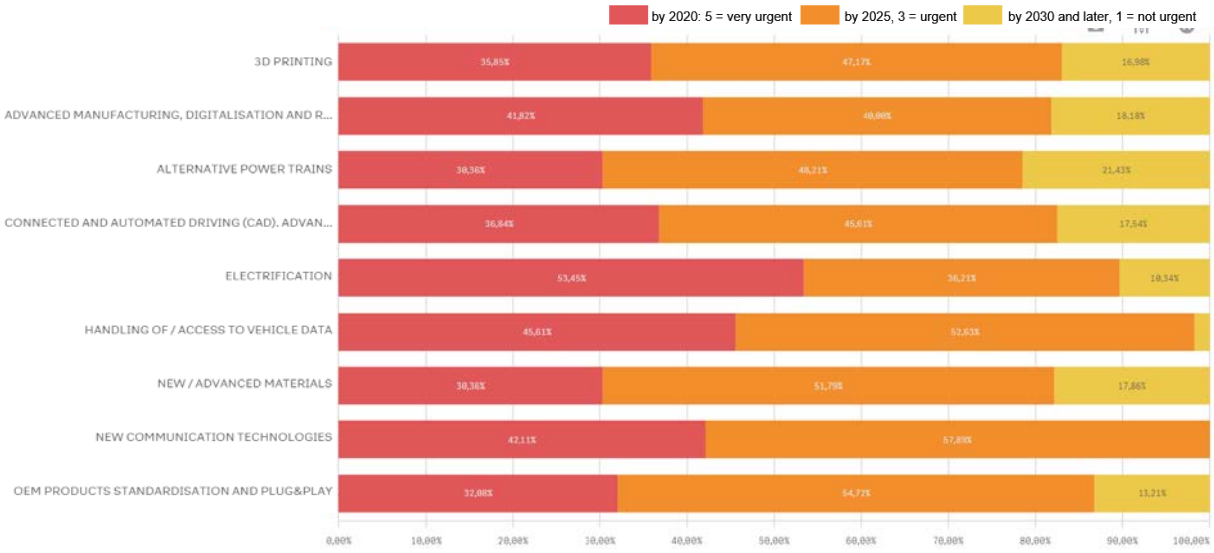

Figure 38: KPI 2.4 (Offer) Drivers of Change – Group NEW TECHNOLOGIES AND BUSINESS MODELS - URGENCY - Overall

Figure 38 sets out an analysis of the timeframe (urgency) within which the "NEW TECHNOLOGIES AND BUSINESS MODEL GROUP" Drivers of Change will impact on the need for changes in provision to meet changing skill requirements. "NEW COMMUNICATION TECHNOLOGIES", "HANDLING OF / ACCESS TO VEHICLE DATA" and "ELECTRIFICATION" are ranked as the TOP3 in terms of urgency, based on the combined scores for 'very urgent' (score of 5) and 'urgent' (score of 4). This is also the case if the scores for 'very urgent' action is considered, indicating there is little change in priorities over the next 5 years.

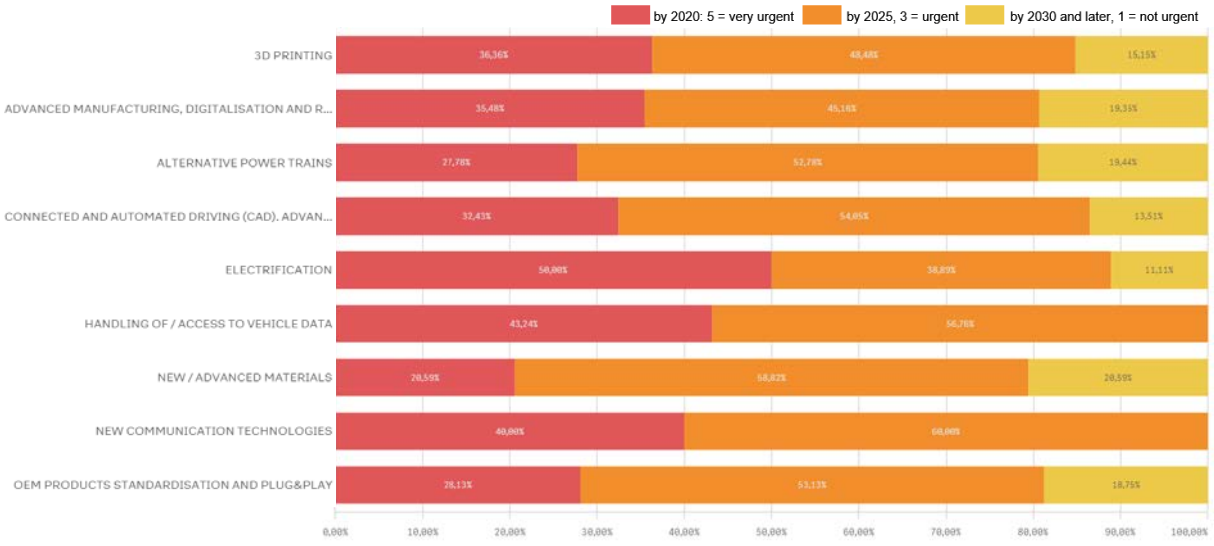

Figure 39: KPI 2.4 (Offer) Drivers of Change – Group NEW TECHNOLOGIES AND BUSINESS MODELS - URGENCY – VET sample

Figure 39 sets out the same analysis but from the perspective of VET providers. The analysis points to a broadly similar pattern in relation to levels of urgency for both "very urgent (by 2020)" and "urgent (by 2025).

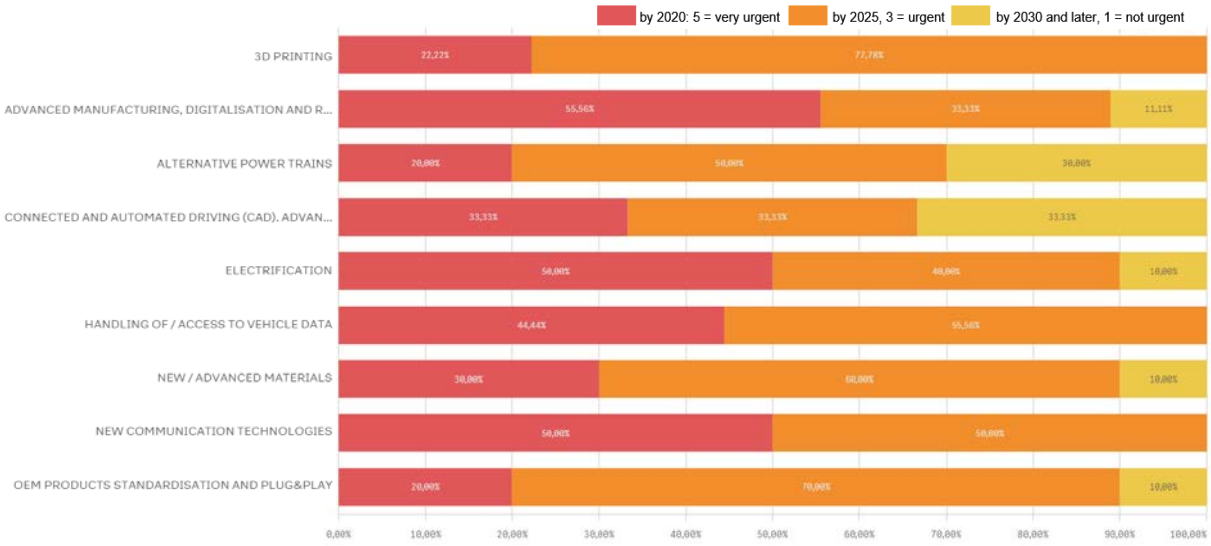

Figure 40: KPI 2.4 (Offer) Drivers of Change – Group NEW TECHNOLOGIES AND BUSINESS MODELS - URGENCY – INSTITUTE sample

Figure 40 outlines the same analysis but from the perspective of Institutes. The analysis indicates that for this group of stakeholders the need for "very urgent (by 2020)"action is less frequently cited in a number of areas such as 3D PRINTING", "ALTERNATIVE POWERTRAINS" and "OEM PRODUCTS STANDARDISATION AND PLUG&PLAY". If those identifying the need for action as "very urgent (by 2020)" and/or "urgent (by 2025) is considered, the TOP 3 most urgent specific Drivers of Change are "3D PRINTING", "HANDLING OF VEHICLE DATA", and "NEW COMMUNICATION TECHNOLOGIES".

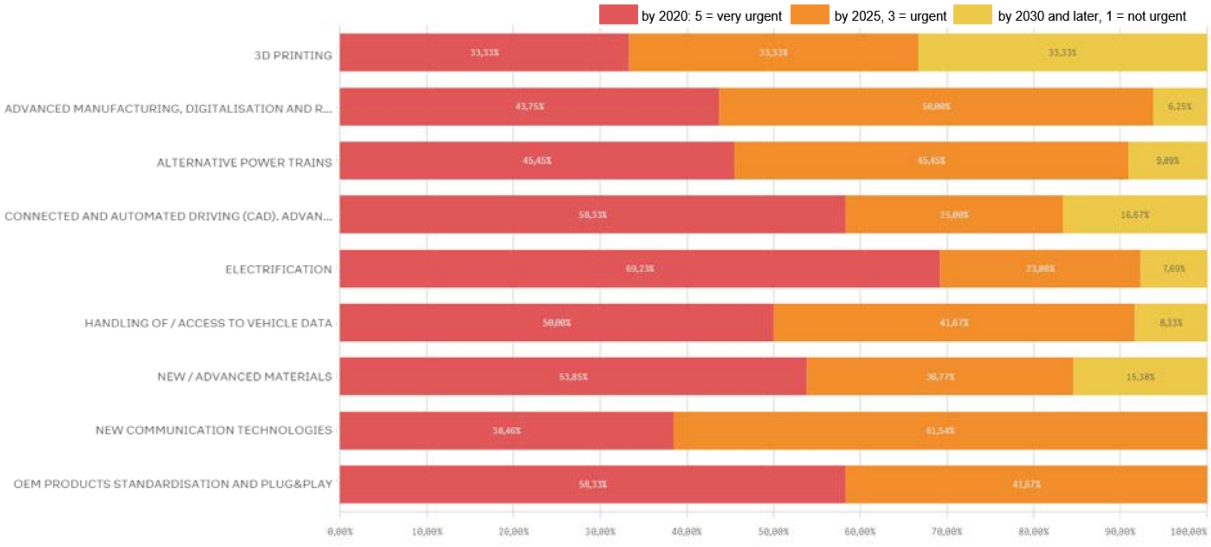

Figure 41: KPI 2.4 (Offer) Drivers of Change – Group NEW TECHNOLOGIES AND BUSINESS MODELS - URGENCY - PRIVATE sample

The need for changes in provsion to meet changing skill requirements will impact over a longer time horizon in the case of "3D PRINTING" according to private companies, as set out in **Figure 41**. The need

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for changes over the next 5 years is identified as greatest with respect to the impacts of "NEW COMMUNICATION TECHNOLOGIES" and "OEM PRODUCTS STANDARDISATION AND PLUG&PLAY". This might be linked to the fact that "3D PRINTING" technologies are more of a niche area for many companies and not adopted widely, unlike ICT skills which impacts on the majority of companies.

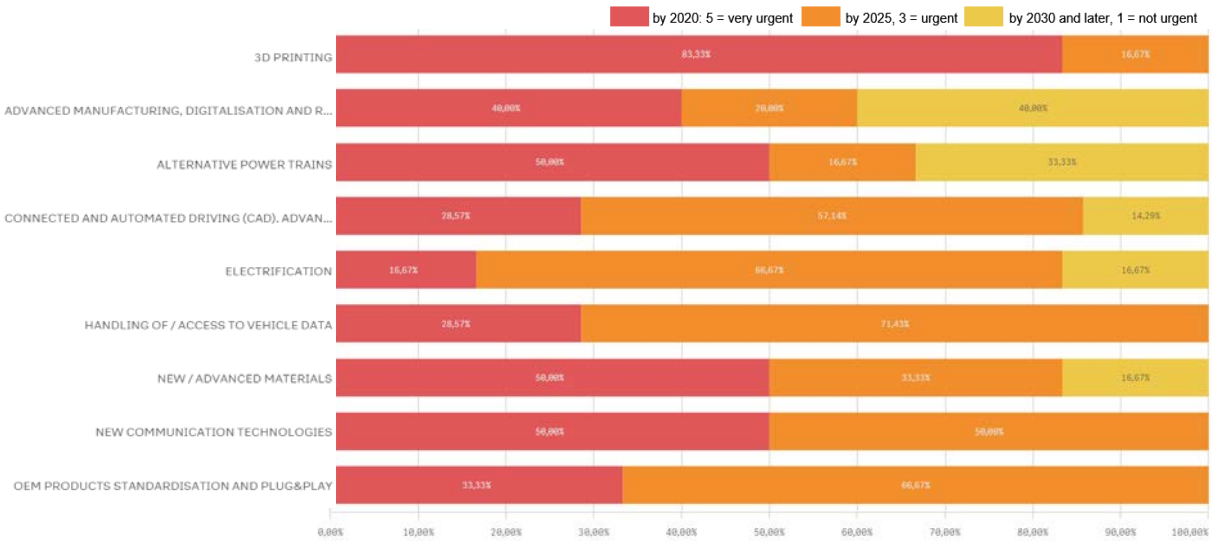

Figure 42: KPI 2.4 (Offer) Drivers of Change – Group NEW TECHNOLOGIES AND BUSINESS MODELS - URGENCY - UMBRELLA ORG. sample

Figure 42 outlines the same analysis but for Umbrella organisations. The analysis indicates that the impacts of "ADVANCED MANUFACTURING, DIGITALISATION AND ROBOTIZATION OF THE MANUFACTURING PROCESS" and "ALTERNATIVE POWERTRAIN" technologies is not perceived as primarily an issue to tackle over the next 5 years in terms of changes to provision. The more urgent priorities over the next 5 years ("very urgent" and/or "urgent") are identified as "OEM PRODUCTS STANDARDISATION AND PLUG&PLAY" , "NEW COMMUNICATION TECHNOLOGIES", "HANDLING OF / ACCESS TO VEHICLE DATA", and "3D PRINTING", with 100% of respondents indicating action is required over this period.

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6.2.7 DIFFERENCE BETWEEN DEMAND AND OFFER

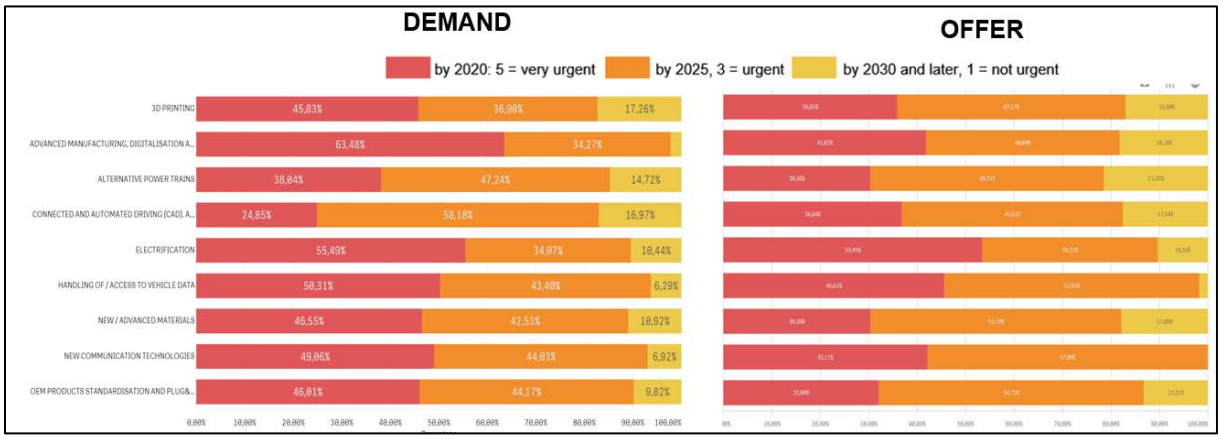

Figure 43: NEW TECHNOLOGIES AND BUSINESS MODELS - URGENCY - comparison between the 2 surveys

From a Demand perspective “ADVANCED MANUFACTURING, DIGITALISATION AND ROBOTIZATION OF THE MANUFACTURING PROCESS”, “HANDLING OF / ACCESS TO VEHICLE DATA” and ”NEW COMMUNICATION TECHNOLOGIES” are the TOP3 ranked drivers in relation to urgency (**Figure 43**). This compares with the offer perspective where ”NEW COMMUNICATION TECHNOLOGIES”, “HANDLING OF / ACCESS TO VEHICLE DATA” and “ELECTRIFICATION” are ranked as the TOP3 with “ADVANCED MANUFACTURING, DIGITALISATION AND ROBOTIZATION OF THE MANUFACTURING PROCESS” ranked as last but one important in terms of levels of urgency. No significant differences in these patterns are evident when the scores for ‘very urgent’ (score of 5) and ‘urgent’ (score of 4) are combined. Tackling the impacts of all Drivers of Change have been identified as urgent over the next 5 years by both the Demand and Offer surveys, with only priorities on how to tackle these impacts differing.

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6.2.8 CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES

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

Individual Drivers of Change in this category are:

- **Batteries efficiency**

  The necessity to store electric energy within a vehicle is an intrinsic necessity of a car. In the case of an electric vehicle, the battery can be compared to the gasoline/diesel tank of an internal combustion engine car: it is the place where the energy to move the vehicle is stored. An increase in its efficiency means more range for the vehicle and a rapid refuelling.

- **Low and Zero-emission vehicles**

  The automotive market is being challenged to develop more energy-efficient engines and alternative powertrains to comply with the evolving standards in terms of pollution and CO2 emissions. Due to new international regulations, consumers will have the possibility to choose from a mix of powertrains that best meet their lifestyle needs, for example, more efficient internal combustion engines, battery electric vehicles (BEVs), hybrid electric vehicles (HEVs), Plug-in Hybrid Electric Vehicle (PHEVs), fuel cells and vehicles powered by natural gas.

- **Improved charging/refuelling infrastructure**

  The need for a widespread refuelling infrastructure is a key driver to boost the commercialisation of a technology based on a new energy carriers. The easier the access to a rapid refuelling and recharging infrastructure the quicker will be the development of such new technologies.

- **Greater range autonomy**

  The range autonomy of a vehicle is an essential factor to be considered when a new powertrain technology arises and innovations relating to this are a key driver of change in the sector.

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6.2.8.1 Climate Goals, Environmental and Health Challenges: Importance

Figure 44: KPI 2.5 (Offer) Drivers of Change – Group CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - IMPORTANCE – Overall sample

Figure 44 shows the relative importance of each specific Driver of Change within the "CLIMATE GOAL, ENVIRONMENTAL AND HEALTH CHALLENGES" 'macro' Driver of Change, based on responses from all stakeholders participating in the 'offer' survey. Taking into account only those responses with a score of 5, "LOW AND ZERO-EMISSION VEHICLES" is ranked as the most important driver of change (62%), followed by "BATTERY EFFICIENCY" with a slightly lower percentage (56%). Based on this criteria, "IMPROVED CHARGING/REFUELLING INFRASTRUCTURE" and "GREATER RANGE AUTONOMY" are ranked third and fourth respectively.

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Figure 45: KPI 2.5 (Offer) Drivers of Change – Group CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - IMPORTANCE – VET sample

Figure 45 shows the relative importance of each specific Driver of Change, for the VET centres. The analysis is similar to that for all stakeholders with the most important Drivers of Change (based on a score of 5) being: "LOW AND ZERO-EMISSION VEHICLES" ranked first, followed by "BATTERY EFFICIENCY", second, and "IMPROVED CHARGING/REFUELLING INFRASTRUCTURE" and "GREATER RANGE AUTONOMY", third and fourth respectively.

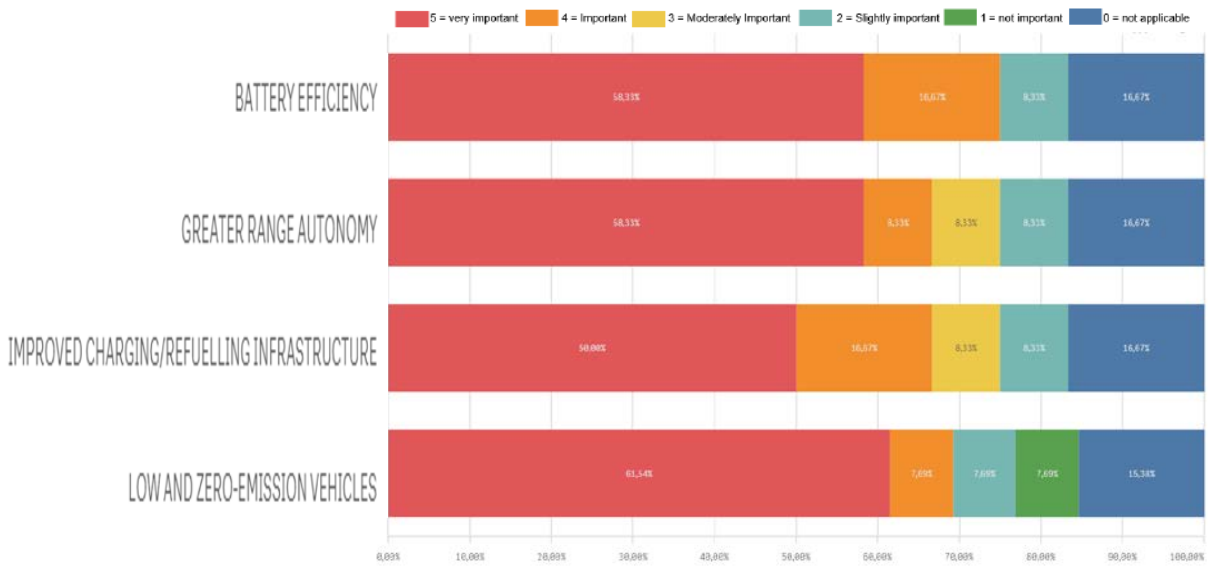

Figure 46: KPI 2.5 (Offer) Drivers of Change – Group CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - IMPORTANCE – INSTITUTE sample

Figure 46 sets out the same analysis but with respect to Institutes. The analysis indicates that the perceptions of Institutes are significantly different to the results for all stakeholders, with a broadly similar level of importance attached to all specific Drivers. Looking in more detail, "LOW AND ZERO EMISSION VEHICLES" is the most important Driver of Change, based on those respondents assigning a

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score of 5 (61%), followed by “GREATER RANGE AUTONOMY” and “BATTERY EFFICIENCY”, both at 58%. If the combined scores of 4 and 5 are considered, “BATTERY EFFICIENCY” becomes the most important Driver of Change.

Figure 47: KPI 2.5 (Offer) Drivers of Change – Group CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - IMPORTANCE – PRIVATE COMPANY sample

Figure 47 sets out the analysis of the importance of the “CLIMATE GOAL, ENVIRONMENTAL AND HEALTH CHALLENGES” macro Driver of Change, but for Private Companies. Taking just those responses with a score of 5, a similar to pattern to that of responses from all stakeholders is evident: “LOW AND ZERO-EMISSION VEHICLES” is ranked first, followed by “BATTERY EFFICIENCY”, ranked second, and “IMPROVED CHARGING/REFUELLING INFRASTRUCTURE” and “GREATER RANGE AUTONOMY”, third and fourth respectively. However, it should be noted that in the case of Private Companies the gap between the first and the second ranked categories has increased, and so has the gap between these first two categories and that of “GREATER RANGE AUTONOMY” and “IMPROVED CHARGING/REFUELLING INFRASTRUCTURE” both at 40%.

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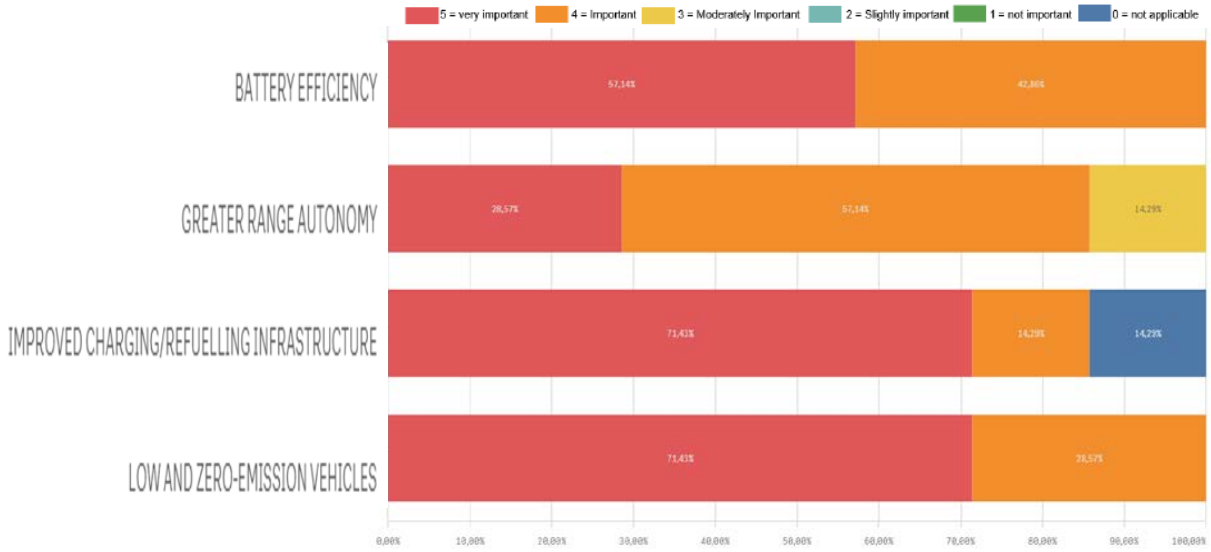

Figure 48: KPI 2.5 (Offer) Drivers of Change – Group CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - IMPORTANCE – UMBRELLA ORG. sample

Responses in relation to umbrella organisations, as outlined in **Figure 48**, point to a number of differences to responses from other groups of stakeholders. In this case both "IMPROVED CHARGING/REFUELLING INFRASTRUCTURE" and "LOW AND ZERO EMISSION VEHICLES" are ranked joint first, when only those responses with a score of 5 are considered at 71%, and "BATTERY EFFICIENCY" falls to third position (57%). However, when scores of 4 and above are considered, both "BATTERY EFFICIENCY" and "LOW AND ZERO EMISSION VEHICLE" are joint first at 100%.

6.2.9 DIFFERENCE BETWEEN DEMAND AND OFFER

Figure 49: CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES – IMPORTANCE - comparison between the 2 surveys

There are very slight differences in response patterns when the demand and offer surveys are compared (**Figure 49** Almost the same percentages of responses for each Driver of Change are evident, with the biggest difference being in relation to "BATTERY EFFICIENCY", which is considered slightly more important from an offer perspective, but only if scores of 3 and above are taken into account.

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6.2.9.1 Climate Goals, Environmental and Health Challenges: Urgency

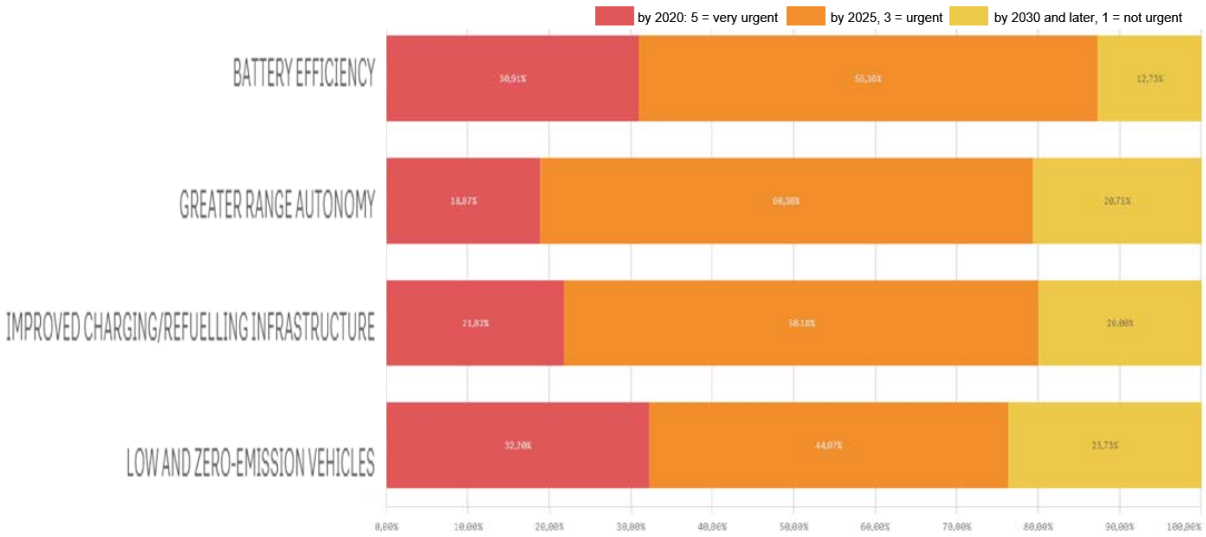

Figure 50: KPI 2.6 (Offer) Drivers of Change – Group CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - URGENCY – Overall sample

Figure 50 sets out an analysis of the timeframe (urgency) within which the "CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES" Drivers of Change will impact on the need for changes in provision to meet changing skill requirements. The most frequently cited time period is "by 2025", this being the case for between 44-60% of responses relating to all specific Drivers of Change in this group. Between 12 and 23% of responses pointed to a less urgent need for action (by 2030 or later).

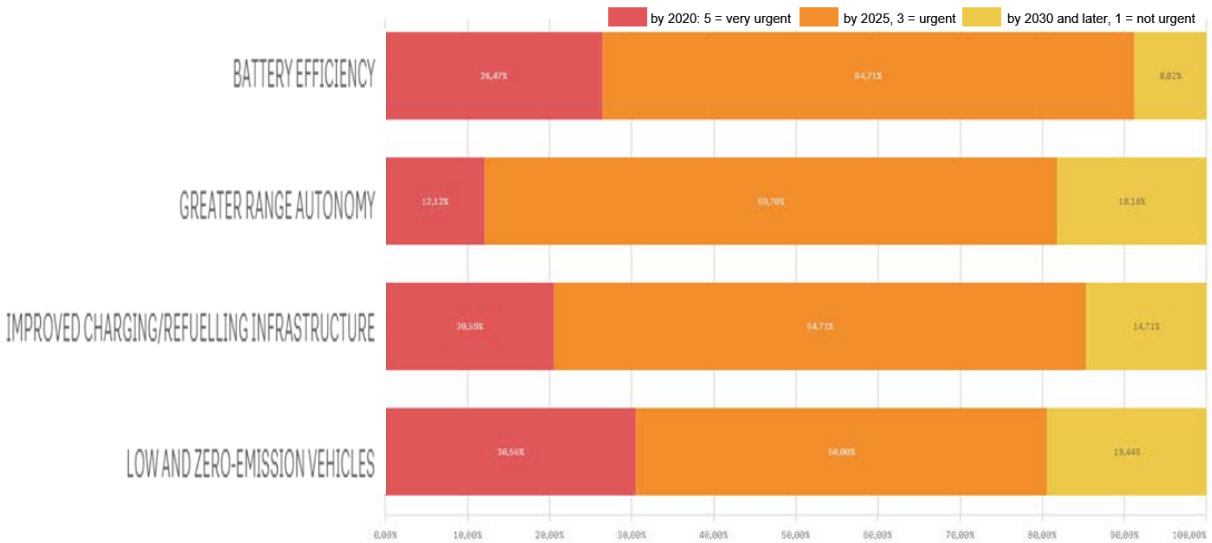

Figure 51 KPI 2.6 (Offer) Drivers of Change – Group CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - URGENCY – VET sample

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Figure 51 sets out responses of VET centres and indicates that responses broadly follow the same pattern to that of the whole sample, although VET centres were somewhat less likely to indicate the need for shorter term action (Very urgent by 2020) and more likely to identify the need for medium-term action (by 2025).

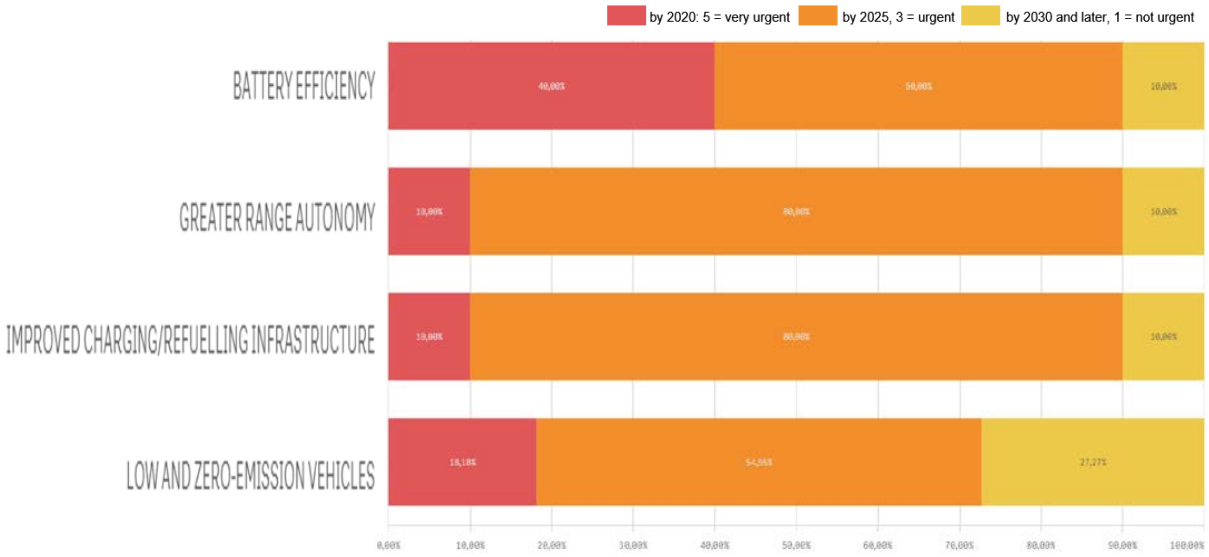

Figure 52: KPI 2.6 (Offer) Drivers of Change – Group CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - URGENCY – INSTITUTE sample

Figure 52 sets out the same analysis but for Institutes. The analysis indicates that a relatively high proportion (40%) indicated 'very urgent' action was required in the case of "BATTERY EFFICIENCY". The need to respond to changes over the medium term (by 2025) was most frequently cited in the case of "GREATER RANGE AUTONOMY" and "IMPROVED CHARGING AND REFUELLING INFRASTRUCTURE" (80% in each case). "LOW AND ZERO EMISSION VEHICLES" is the Driver of Change ranked second in terms of the proportion of responses indicating a 'very urgent' response is needed (18%). However, this contrasts with 27% of responses from these stakeholders indicating that a response to these changes is only needed in the longer-term (by 2030 or later).

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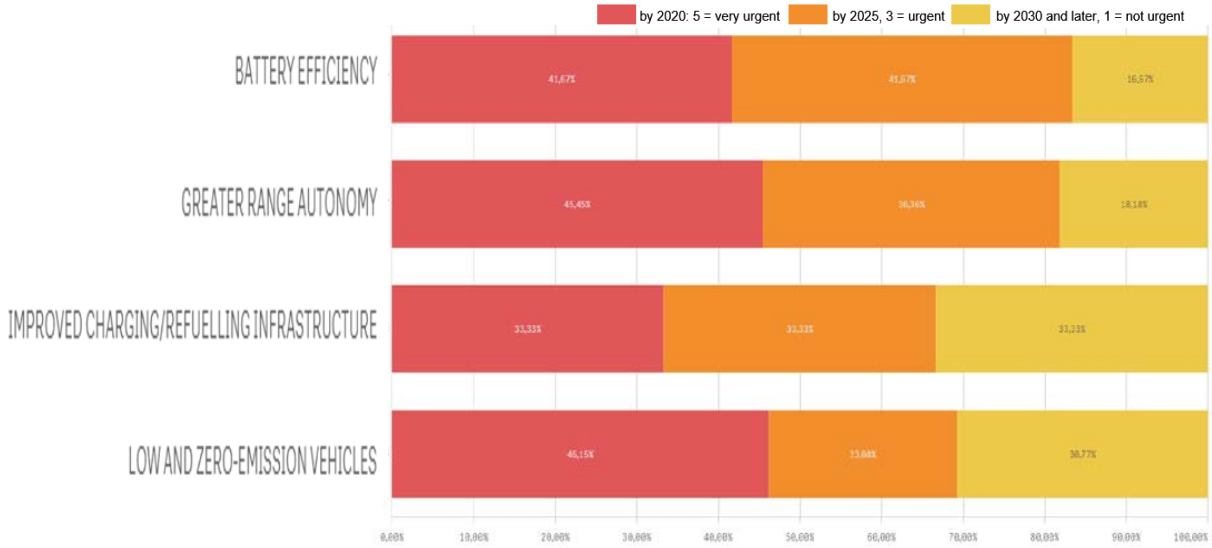

Figure 53: KPI 2.6 (Offer) Drivers of Change – Group CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - URGENCY – PRIVATE

As shown in **Figure 53**, private companies are more likely to assign action as 'very urgent' with respect to all the drivers of change, particularly "LOW AND ZERO EMISSION VEHICLES" (46% by 2020) and "GREATER RANGE AUTONOMY" (45% by 2020). This group is also least likely to assign action as "not urgent", when compared to the whole sample and other categories of stakeholders, with the proportion of such responses ranging from 15% to 30%.

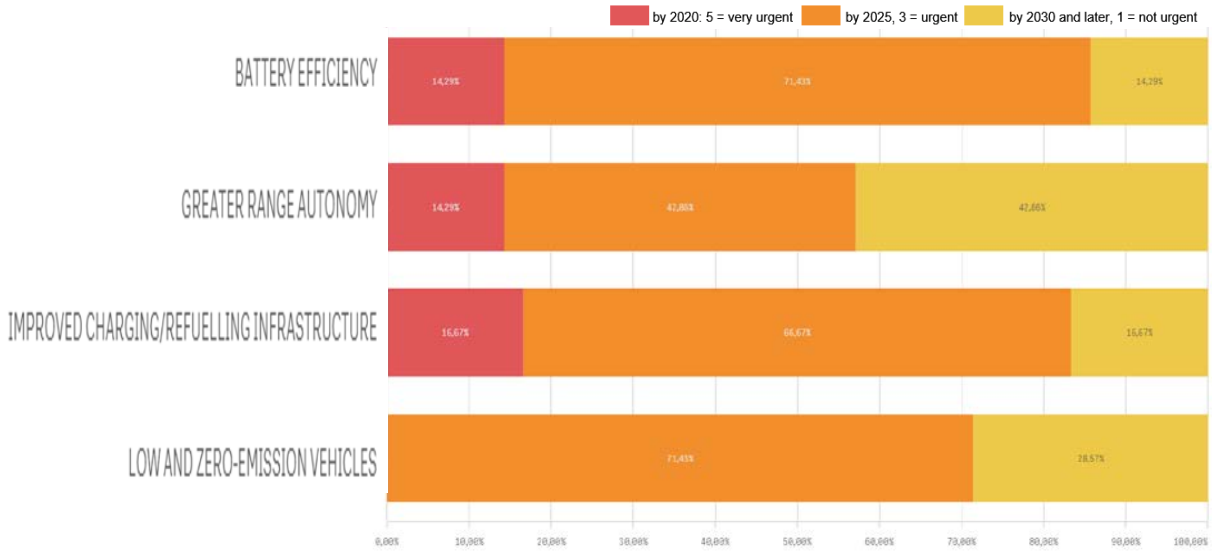

Figure 54: KPI 2.6 (Offer) Drivers of Change – Group CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - URGENCY – UMBRELLA ORG. sample

Figure 54 indicates that responses from Umbrella organisations differ somewhat when compared to other stakeholders. Umbrella organisations are more likely to consider action as "not urgent" with respect to all Drivers of change, particularly in the case of "GREATER AUTONOMY" (42% by 2030) and least likely to identify action as 'very urgent' (by 2020).

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6.2.10 DIFFERENCE BETWEEN DEMAND AND OFFER

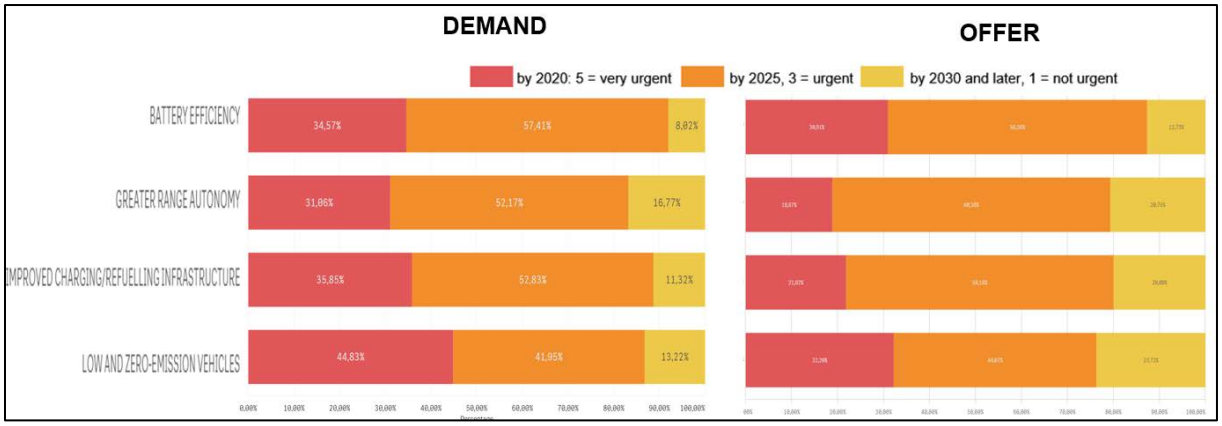

Figure 55: CLIMATE GOALS, ENVIRONMENTAL AND HEALTH CHALLENGES - URGENCY - comparison between the 2 surveys

Although from both a Demand and Offer perspective (**Figure 55**), most Drivers have a predominant focus on a mid-term urgency time horizon (by 2025), from a demand perspective a short-term time horizon (very urgent) is more likely to be assigned in the case of all the Drivers, with a higher likelihood of a longer term time horizon in terms of urgency being assigned from an offer perspective. In most of cases, a difference of 10 percentage points between the urgency score from a Demand and Offer perspective is evident. This is probably linked to a greater concern from a Demand perspective of environmental issues and less familiarity with the technical, industrial and economic feasibility of tackling the impact of each Driver of Change.

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

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

Individual Drivers of Change in this category are:

- **Mobility as a Service (MaaS)**

  Car-sharing and ride-hailing mobile apps are a couple of examples of how the concept of mobility is changing, with consumers more and more interested in the “final service” than in the product. Using, instead of owning might be an important driver changing the approach to product, market and services within the automotive sector.

- **Increased connectivity / infrastructure (V2X)**

  A vehicle is a connected entity able to monitor, in real time, its own parts and safety conditions around it. This trend is growing, and the car of the future will be connected to other vehicles (V2V- vehicle to Vehicle) and to any entity (V2X- Vehicle to Everything) that may affect the vehicle itself. The acronyms V2X refers to a form of technology that allows vehicles to communicate with moving parts of the traffic system around them and vice-versa. In this context, different communication technologies such as 5G (long-range) and/or ITS-G5 (short-range system) infrastructure will be deployed along major terrestrial transport paths.

- **Data Access**

  Higher connectivity of vehicles will also generate large amounts of new data. This will need to be considered as appropriate policy and legal solutions are found for the problems of vehicle integrity, security, road safety and liability. These will support the emergence of new business models and it is likely that this will include provision for direct, safe and secure access to a wide set of vehicle data for the provision of connected services.

- **Cybersecurity**

  There will also be an impact from evolving legal requirements, consumer demands and acceptance of new technologies.

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6.2.11.1 Societal Changes and Change in the Way that Consumer Access, Purchase and Use the Cars: Importance

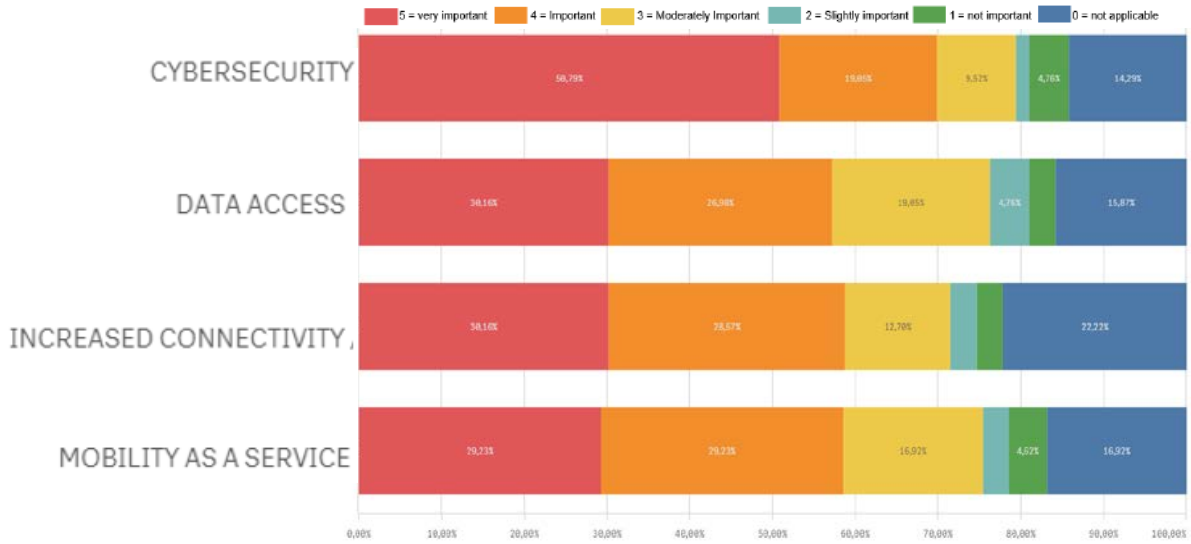

Figure 56: KPI 2.7 (Offer): Drivers of Change – Group SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS: IMPORTANCE – Overall sample

Figure 56 shows the relative importance of each specific Driver of Change within the "SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS" 'macro' Driver of Change, based on responses from all stakeholders participating in the 'offer' survey. Considering only those responses with a score of 5, "CYBERSECURITY" is the most important specific Driver of Change, followed by "DATA ACCESS" and "INCREASED CONNECTIVITY / INFRASTRUCTURE (V2X)", (both at 30%). This is followed closely by "MOBILITY AS A SERVICE" (29% assigning a score of 5) on this basis. If all responses scoring between 3-5 in terms of importance are considered, "CYBERSECURITY" is ranked first in terms of importance (73%), followed closely by "DATA ACCESS" (76%), "MOBILITY AS A SERVICE" (75%) and "INCREASED CONNECTIVITY / INFRASTRUCTURE (V2X)" (71%).

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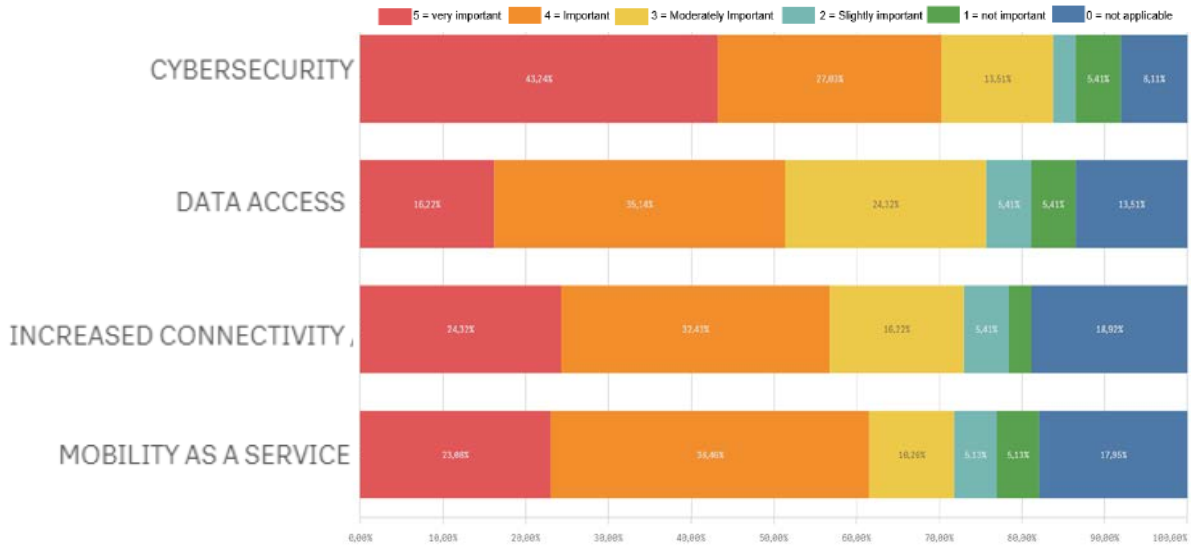

Figure 57: KPI 2.7 (Offer): Drivers of Change – Group SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS: IMPORTANCE – VET sample

Looking at the same analysis but just in relation to the VET sample of stakeholders, **Figure 57** indicates that if all scores of 3 or above are included, "CYBERSECURITY" is identified as of greatest importance (84%), followed by "DATA ACCESS" (76%).

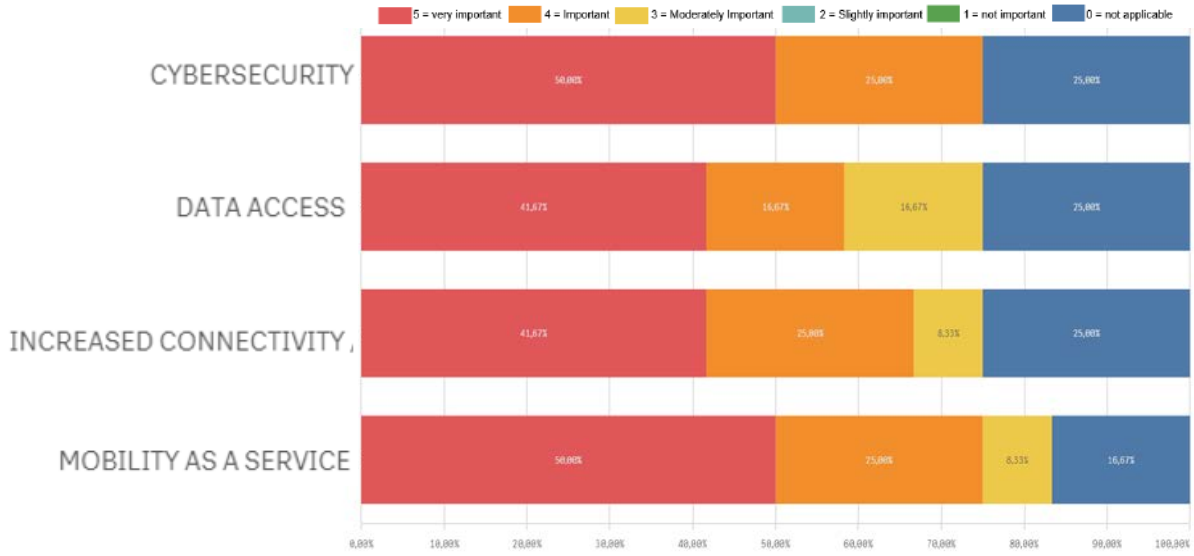

Figure 58: KPI 2.7 (Offer): Drivers of Change – Group SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS: IMPORTANCE – INSTITUTE sample

Undertaking the same analysis but solely in relation to responses from INSTITUTEs (**Figure 58**), "MOBILITY AS A SERVICE" is identified as the most important specific Driver of Change based on those assigning a score of 3-5, with all other Drivers of Change receiving the same proportion of responses measured on this basis. A relatively high proportion of "not relevant" responses should be noted in relation to Institutes.

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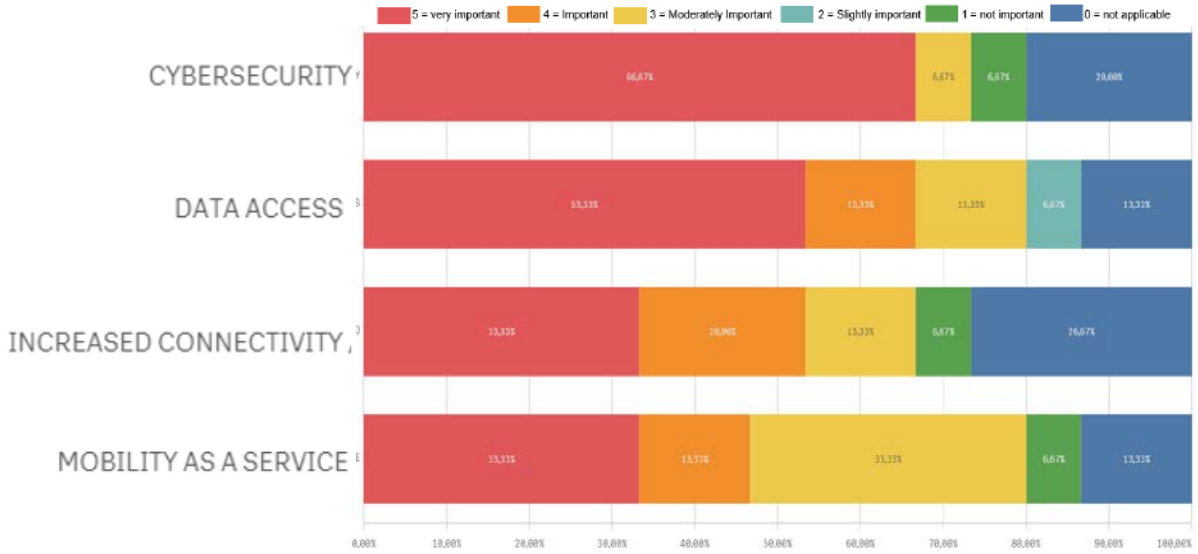

Figure 59: KPI 2.7 (Offer): Drivers of Change – Group SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS: IMPORTANCE – PRIVATE COMPANY sample

Figure 59 sets out the same analysis for KPI 2.7 with respect to the responses from the PRIVATE COMPANY sample. "DATA ACCESS" and "MOBILITY AS A SERVICE" received most preferences for importance scores of 3 or above, while "INCREASED CONNECTIVITY / INFRASTRUCTURE (V2X)" was rated the least important measured on this basis (67% of responses). In relation to "CYBERSECURITY" a relatively high proportion of responses were rated as 'very important' (5) with 67%, followed by "DATA ACCESS", with 53%.

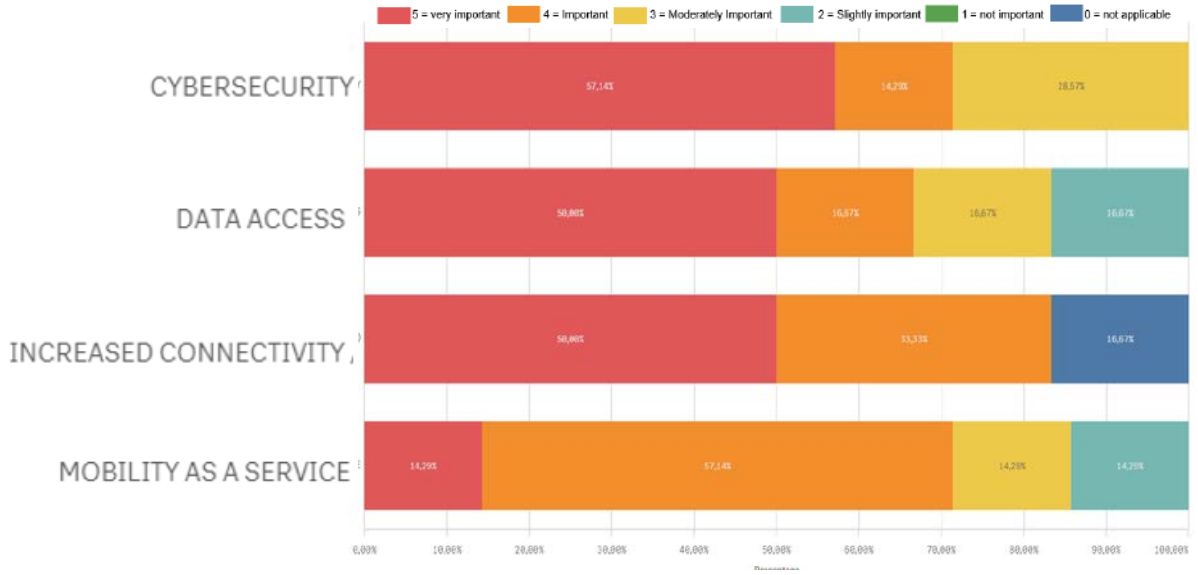

Figure 60: KPI 2.7 (Offer): Drivers of Change – Group SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS: IMPORTANCE – UMBRELLA ORG. sample

Figure 60 set out the same analysis but for UMBRELLA ORGANISATIONs and indicates that all stakeholders (100%) in this category that responded considered "CYBERSECURITY" at least moderately important (score of 3 or above). "INCREASED CONNECTIVITY / INFRASTRUCTURE (V2X)" was

considered important (4) or very important (5) by 83% of the such respondents. “MOBILITY AS A SERVICE” was considered as ‘very important’ by only 14% of these respondents, but as, at least, moderately important by 86% of the sample.

6.2.12 DIFFERENCE BETWEEN DEMAND AND OFFER

Figure 61: SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS - IMPORTANCE - comparison between the 2 surveys

Comparing the importance given to the different Drivers of Change for “SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS” from both a Demand and Offer perspective (**Figure 61**), the following can be noted: “CYBERSECURITY” is considered in general slightly more important from an offer perspective (51% consider this very important) than a Demand perspective (49%). The difference in the perception of importance is slightly larger when those considering this Driver at least moderately important are analysed (76% from a Demand perspective and 79% from an Offer perspective). The opposite is true for “DATA ACCESS”, with 32% of demand side respondents indicating this Driver of Change as very important, whilst this was the case for only 30% from the Offer perspective. When looking at the Driver of Change considered as at least moderately important, the biggest difference in perceptions relate to “INCREASED CONNECTIVITY / INFRASTRUCTURE (V2X)” and “MOBILITY AS A SERVICE”, which are considered more important from a Demand perspective compared with respondents to the Offer survey, with a difference of 3 and 2 percentage points respectively. However, it is interesting to note that both from a Demand and Offer perspective the same level of importance (5 points) for “INCREASED CONNECTIVITY / INFRASTRUCTURE (V2X)” is evident, whilst in relation to “MOBILITY AS A SERVICE” being considered as “very important” this is more likely from the Offer rather than Demand perspective.

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6.2.12.1 *Societal Changes and Change in the Way that Consumer Access, Purchase and Use the Cars: Urgency*

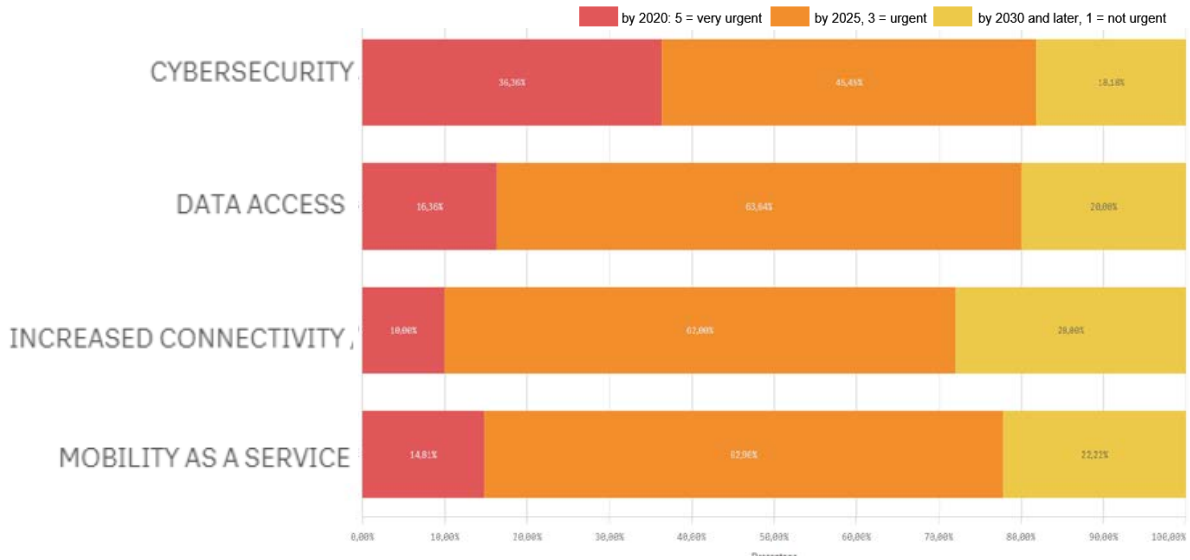

Figure 62: KPI 2.9 (Offer) Drivers of Change – Group SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS: URGENCY – Overall sample

In terms of the 'urgency' of action in relation to each specific Driver of Change, **Figure 62** indicates that the most frequent time period identified was "by 2025". Only in the case of "CYBERSECURITY", is the time horizon considered more urgent, with 36% of the providers responding to the "OFFER" survey indicating 'by 2020' as the most likely timeframe for action.

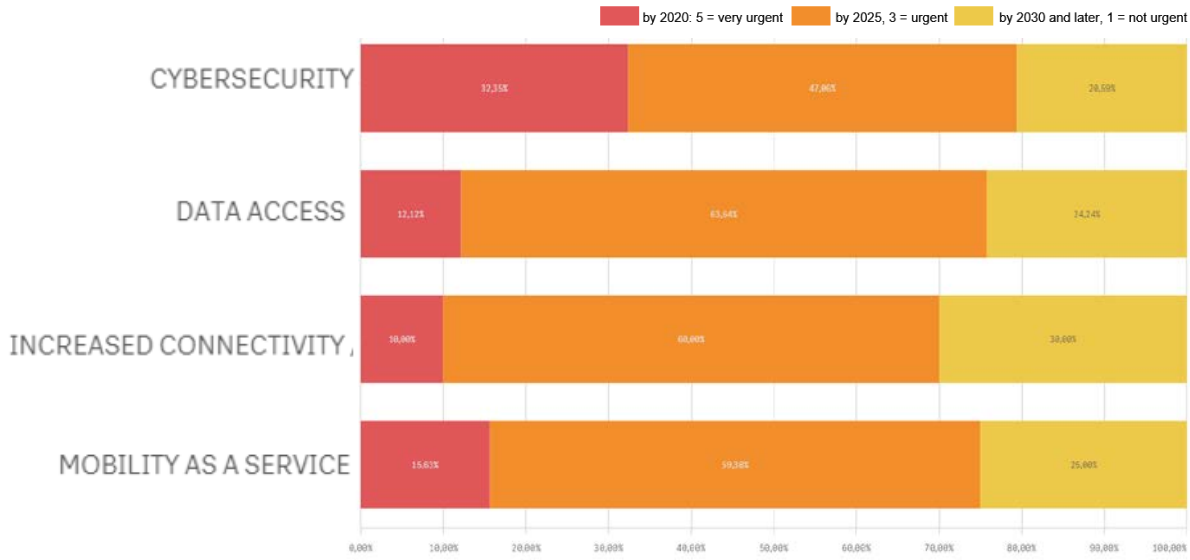

Figure 63: KPI 2.9 (Offer) Drivers of Change – Group SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS: URGENCY – VET sample

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Figure 63 highlights the same analysis but for the VET sample, with 'by 2025' again being the most frequently identified time horizon for action. "CYBERSECURITY" (32%), is again the Driver of Change most likely to be identified as impacting on the need for changes in provision to meet changing skill requirements. This is followed (but some distance behind measured on this basis) by MOBILITY AS A SERVICE (15%).

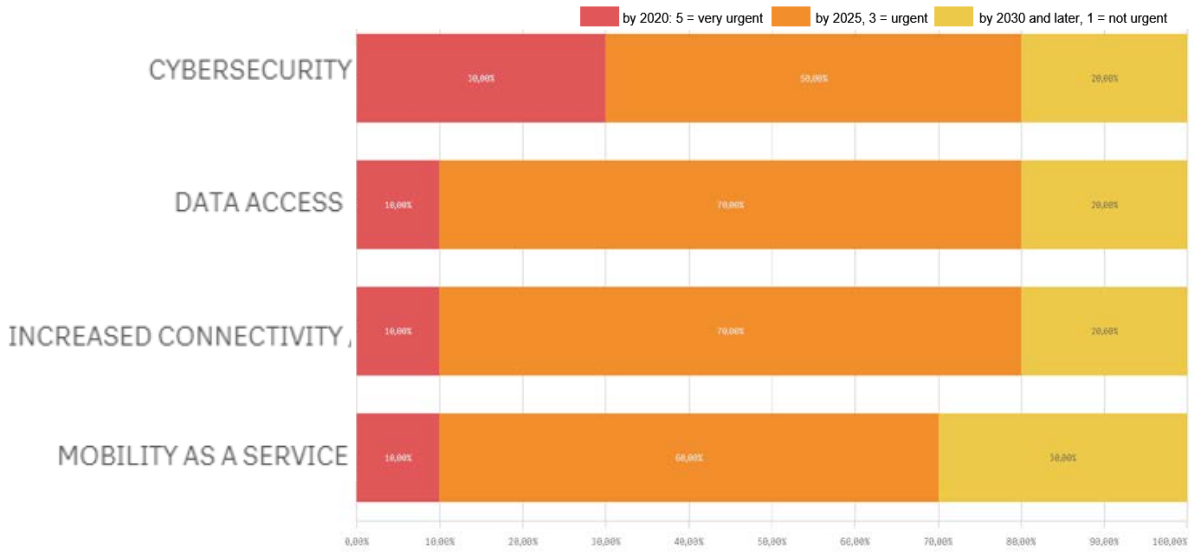

Figure 64: KPI 2.9 (Offer) Drivers of Change – Group SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS: URGENCY – INSTITUTE sample

Figure 64 represents the same analysis for KPI 2.9 but in relation to INSTITUTEs. Again, 'by 2025' is the most frequently cited time horizon for action And, as is the case for other stakeholders, "CYBERSECURITY" is highlighted as requiring more immediate action (by 2020), by 30% of these respondents.

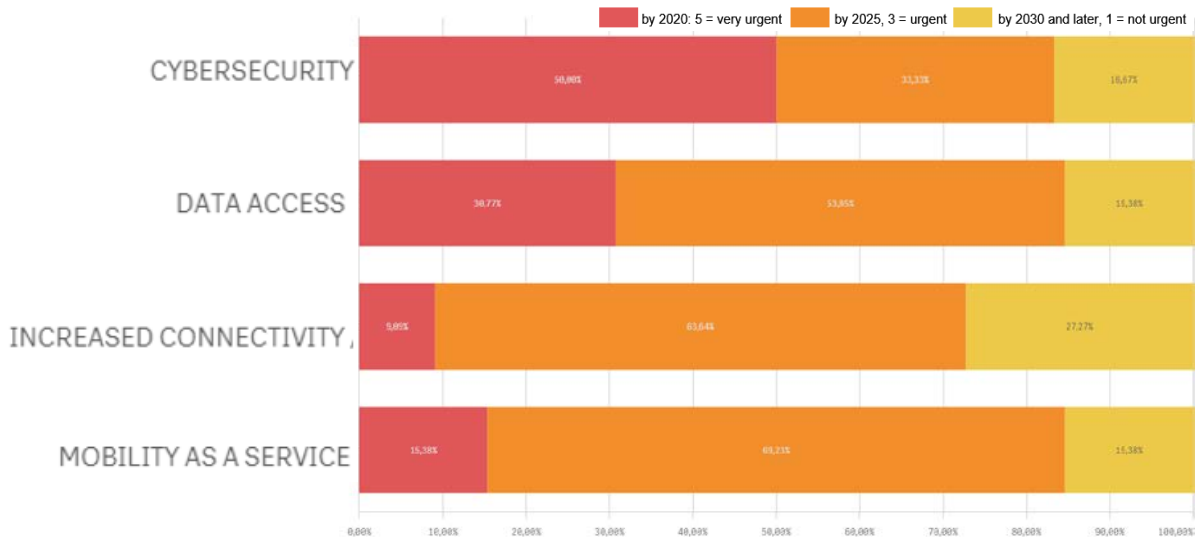

Figure 65: KPI 2.9 (Offer) Drivers of Change – Group SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS: URGENCY – PRIVATE COMPANY sample

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Figure 65 outlines responses from the PRIVATE COMPANY sample, in relation to KPI 2.9. This is the only sample of responses with half or more indicating a VERY URGENT need for action in relation to CYBERSECURITY (50%). A significant proportion 31% of these respondents also indicated that action relating to DATA ACCESS was also very urgent (by 2020). For the remainder of the specific drivers of change relating to this KPI, a time horizon for action of 'by 2025' is the predominant response.

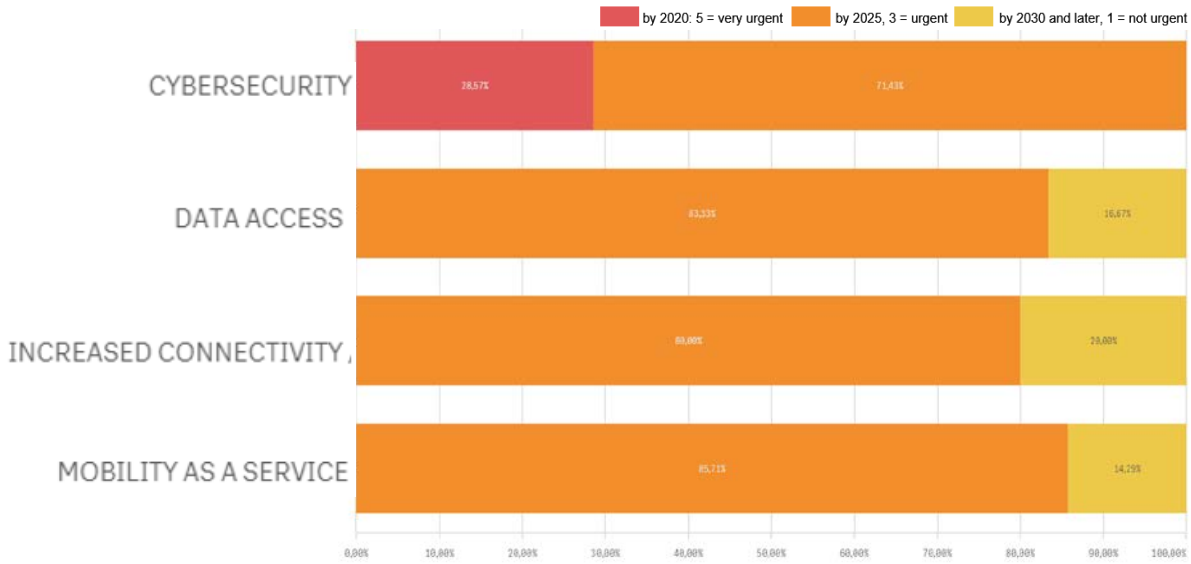

Figure 66: KPI 2.9 (Offer) Drivers of Change – Group SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS: URGENCY – UMBRELLA ORG. sample

Figure 66 outlines responses from the UMBRELLA ORGANISATIONs responding to the survey. For these stakeholders, only CYBERSECURITY is considered as requiring a high level of urgency (by 2020), whilst all other drivers of change are considered urgent (by 2025) in terms of the time horizon for action.

6.2.13 DIFFERENCE BETWEEN DEMAND AND OFFER

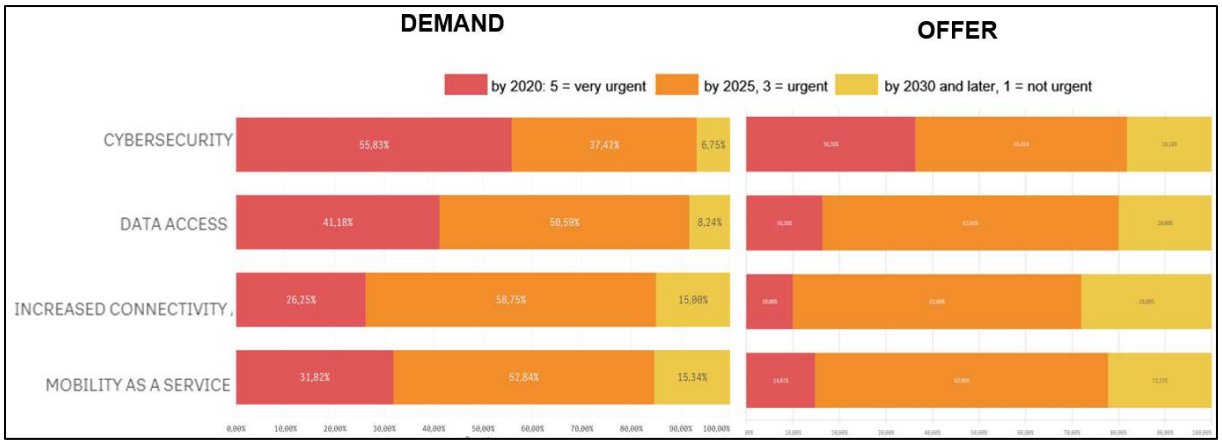

Figure 67: SOCIETAL CHANGES AND CHANGE IN THE WAY THAT CONSUMER ACCESS, PURCHASE AND USE THE CARS – URGENCY - comparison between the 2 surveys

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There is a clear mismatch between perceptions of the urgency of these Drivers of Change from the perspective of Demand and the Offer (**Figure 67**). In general, the perception of urgency is much stronger from a Demand perspective than an Offer perspective for all Drivers of Change. The biggest difference (25 percentage points) relates to "DATA ACCESS", which is ranked the second most urgent issue from a Demand perspective (41% identify this as very urgent). By comparison, only 16% of respondents from the Offer survey considered this very urgent. "CYBERSECURITY" is the most urgent issue from both a Demand and Offer perspective. However, this is much more likely to be perceived as very urgent from a Demand perspective than from an Offer perspective (56% vs 36%). Similar differences in perception are evident with respect to the two remaining drivers: "INCREASED CONNECTIVITY / INFRASTRUCTURE (V2X)" was considered as very urgent by only 10% of respondents from the Offer survey, compared with 26% on the Demand side. "MOBILITY AS A SERVICE" was considered as very urgent by only 15% on the Offer side, whilst this was the case for 32% of the respondents from the Demand survey.

6.2.14 STRUCTURAL CHANGES

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

Individual Drivers of Change in this category are:

- **Restructuring**
  The European automotive sector is expected to undergo structural changes due to the development of digital technologies and the shift towards low and zero emission mobility. The industry, in particular SMEs, will need to assess and, if necessary, redefine their position in the value chain as well as increase their capacity to integrate digital technologies, alternative powertrains and circular economy concepts in their products portfolio and production processes.

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- **Acquisition of new skills**

  The transformation of the automotive industry will have a significant impact on the industry's workforce and the acquisition of news skills will be a key factor enabling employees to be equipped to deal with these changes. These changes will lead to both the creation of new occupations and the need for new skills and competences amongst the existing workforce.

- **Continuous training**

  Continuous training is always useful but during periods of disruptive change continuous training is essential to align competences to changing skill requirements. These activities also need to be supported by actions to improve mobility and transferability of skills, linked to the development of an efficient apprenticeship market and encouragement of informal learning.

6.2.14.1 Structural Changes: Importance

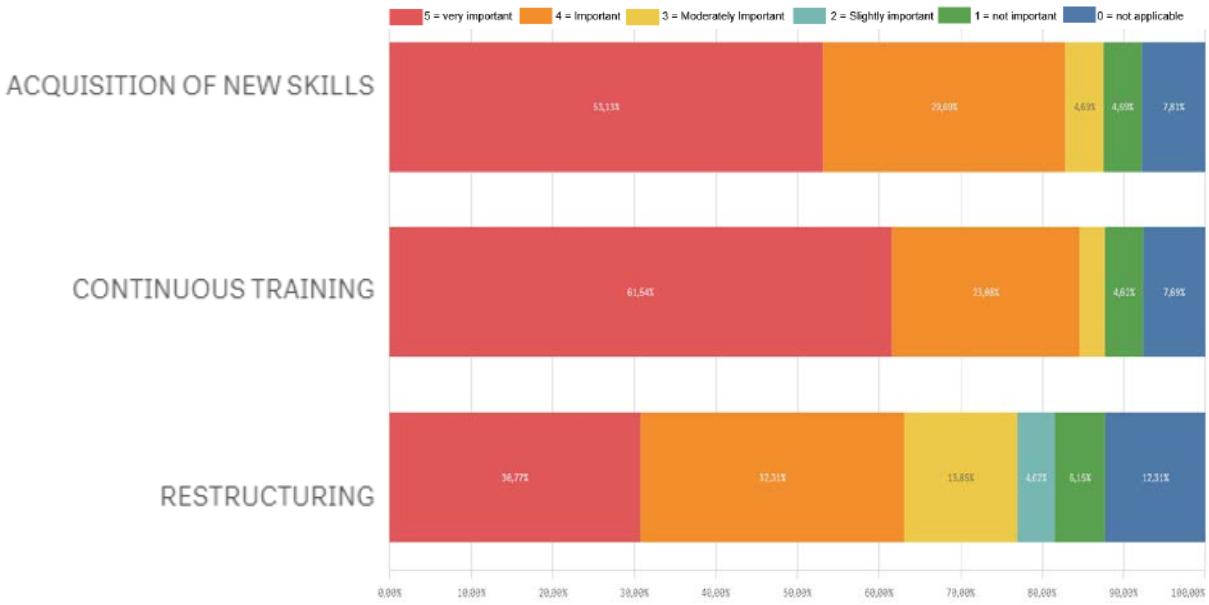

Figure 68: KPI 2.9 (Offer) Drivers of Change – Group STRUCTURAL CHANGES: IMPORTANCE – Overall sample

Figure 68 indicates that "CONTINUOUS TRAINING" is identified as the most important Driver of Change in relation to the overall STRUCTURAL CHANGE category, followed by the "ACQUISITION OF NEW SKILLS". Less than 5% of respondents considered these two Drivers as not important. If 'very important' and 'important' responses are added together more than 80% of respondents consider "CONTINUOUS TRAINING" and "ACQUISITION OF NEW SKILLS" as important and this is the case for more than 60% of respondents with respect to "RESTRUCTURING". The responses are in line with the general EU strategy, supporting lifelong learning and the acquisition and recognition of new skills.

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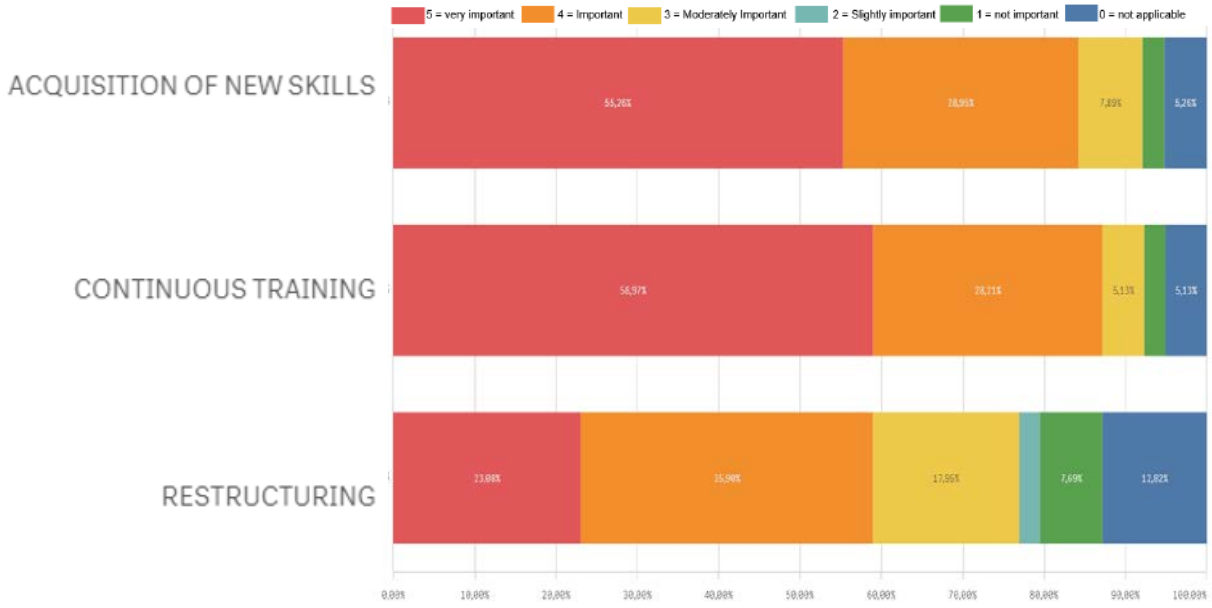

Figure 69: KPI 2.9 (Offer) Drivers of Change – Group STRUCTURAL CHANGES: IMPORTANCE – VET sample

The Responses from VET organisations are broadly aligned with those of the overall sample as **Figure 69** outlines. "CONTINUOUS TRAINING" and "ACQUISITION OF NEW SKILLS" is the primary concern of these respondents with over 80% indicating these are 'very important' or 'important' . As with the case with the overall sample, VET providers attached a somewhat lower level of importance to "RESTRUCTURING".

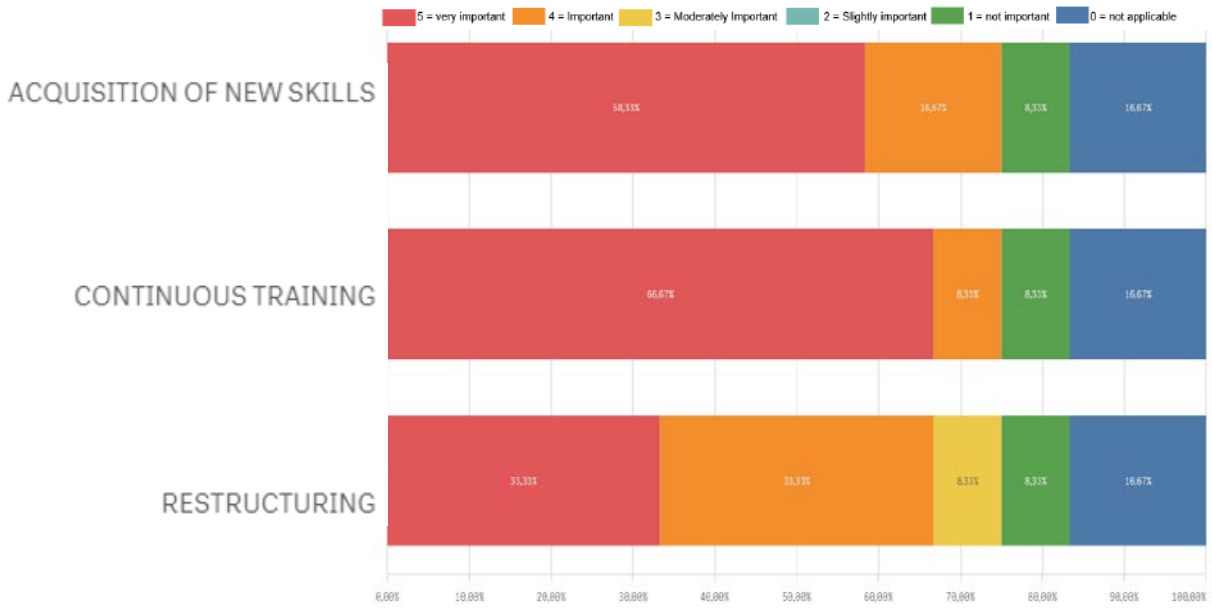

Figure 70: KPI 2.9 (Offer) Drivers of Change – Group STRUCTURAL CHANGES: IMPORTANCE – INSTITUTE sample

The responses from research institutes, accreditation, certification or qualification bodies is set out in **Figure 70** and is broadly aligned with the overall sample. Again, both "CONTINUOUS TRAINING" and "ACQUISITION OF NEW SKILLS" were rated as very important or important by more than 80% of respondents. However, it should be noted that a large proportion of institutions replied that the

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question was 'Not applicable'. Again, "RESTRUCTURING" was rated as of lower importance than the other two Drivers of Change.

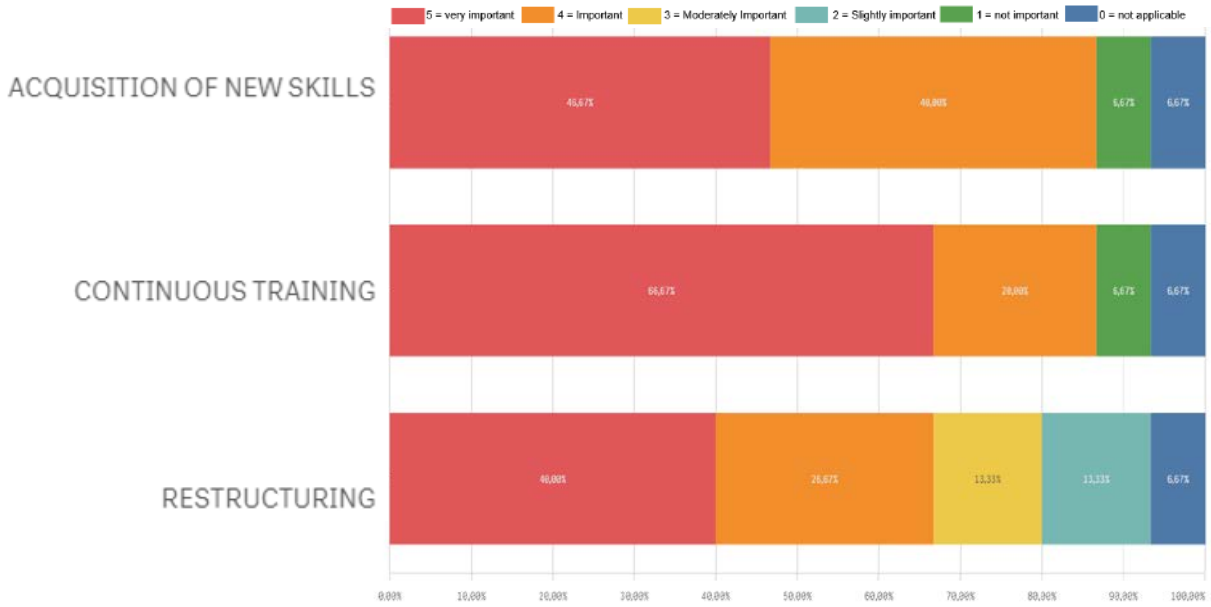

Figure 71: KPI 2.9 (Offer) Drivers of Change – Group STRUCTURAL CHANGES: IMPORTANCE – PRIVATE COMPANY sample

Figure 71 indicates that private companies involved into the VET System rate "CONTINUOUS TRAINING" as the most important driver in relation to STRUCTURAL CHANGES. Both "ACQUISITION OF NEW SKILLS" and "RESTRUCTURING" were rated as roughly equal in importance, if only 'very important'responses are considered (46% vs 40%). If the scores for 'very important' and 'important' are combined, "CONTINUOUS TRAINING" and "ACQUISITION OF NEW SKILLS" account for more than 85% of responses in each case, again in line with all stakeholders. No private companies considered these two drivers as of slight/moderate importance.

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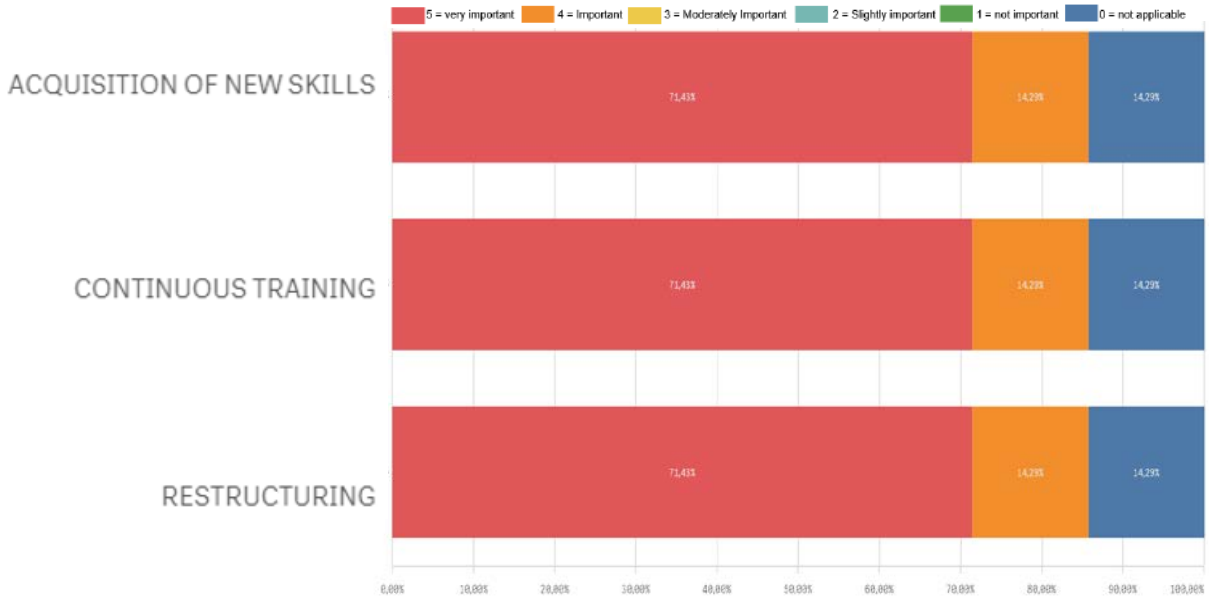

Figure 72: KPI 2.9 (Offer) Drivers of Change – Group STRUCTURAL CHANGES: IMPORTANCE – UMBRELLA ORG. sample

Figure 72 outlines responses from VET umbrella / international organisations and confirms the importance attached to "CONTINUOUS TRAINING" and "ACQUISITION OF NEW SKILLS", although "RESTRUCTURING" is also considered as important by these stakeholders.

6.2.15 DIFFERENCE BETWEEN DEMAND AND OFFER

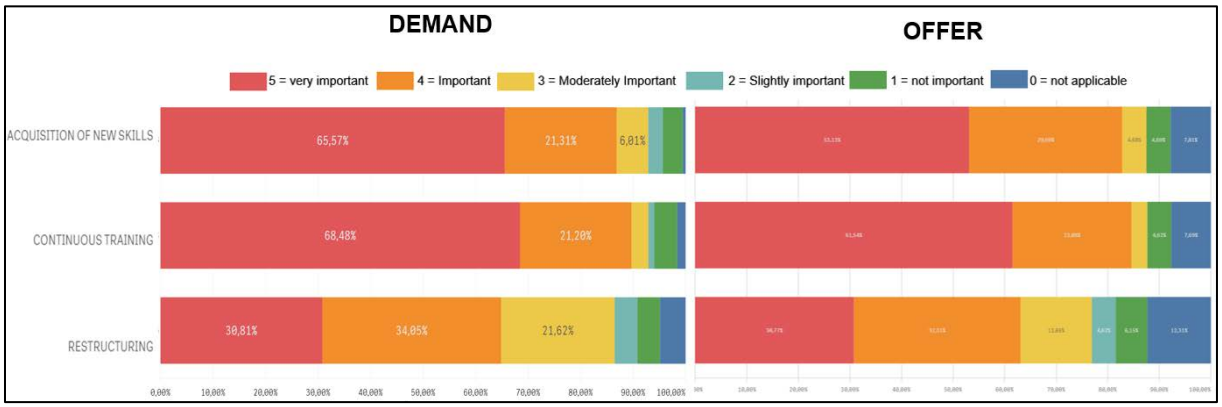

Figure 73: STRUCTURAL CHANGES - IMPORTANCE - comparison between the 2 surveys

Comparison of responses from both a Demand and Offer perspective indicates that the relative importance (based on the combined scores of very important and important) of both "CONTINUOUS TRAINING" and "ACQUISITION OF NEW SKILLS" is very similar (**Figure 73**). Differences are only apparent if the respective weightings in terms of those assigning a very important score are examined in detail. On this basis it is evident that "CONTINUOUS TRAINING" is ranked more important than "ACQUISITION OF NEW SKILLS" by the educational, research and accreditation organisations.

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6.2.15.1 Structural Changes: Urgency

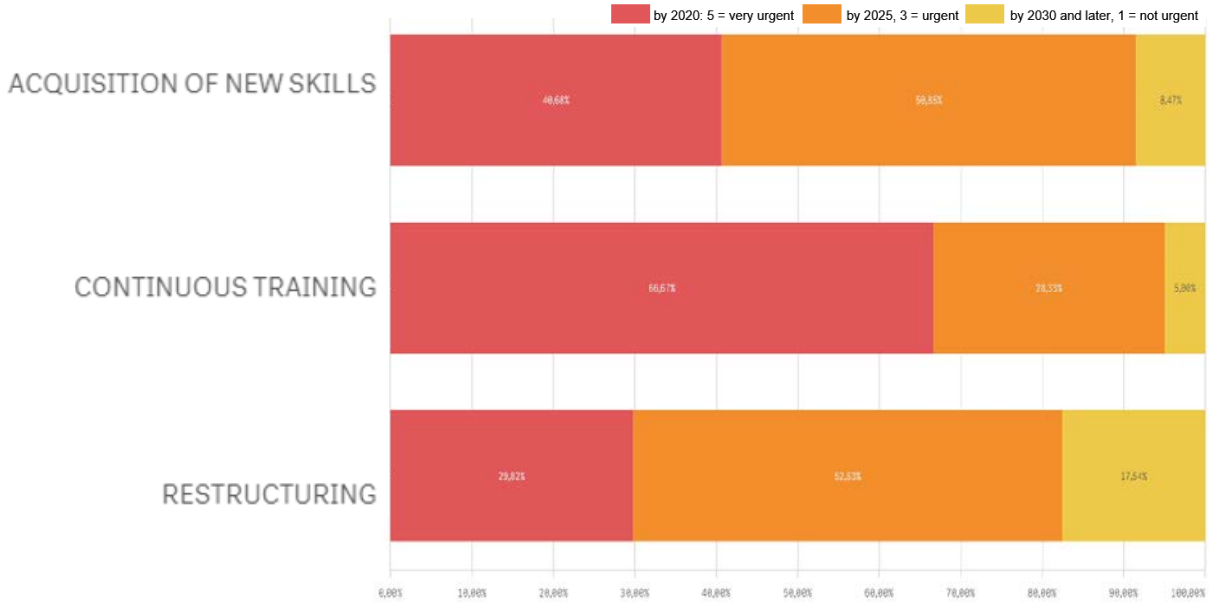

Figure 74 KPI 2.10 (Offer) Drivers of Change – Group STRUCTURAL CHANGES - URGENCY – Overall sample

Figure 74 sets out an analysis of the timeframe (urgency) within which the "STRUCTURAL CHANGES" Drivers of Change will impact on the need for changes in provision to meet changing skill requirements. The analysis indicates that "CONTINUOUS TRAINING" has been identified as 'very urgent' by 66% of the respondents, followed by "ACQUISITION OF NEW SKILLS" (40% of respondents). This is aligned with general EU policy to support continuous learning and acquisition of new skills through lifelong learning programmes. Based on the combined scores for 'very urgent' (score of 5) and 'urgent' (score of 4), "CONTINUOUS TRAINING" is ranked first (95%), followed by "ACQUISITION OF NEW SKILLS" (91%), followed by "RESTRUCTURING" (82%).

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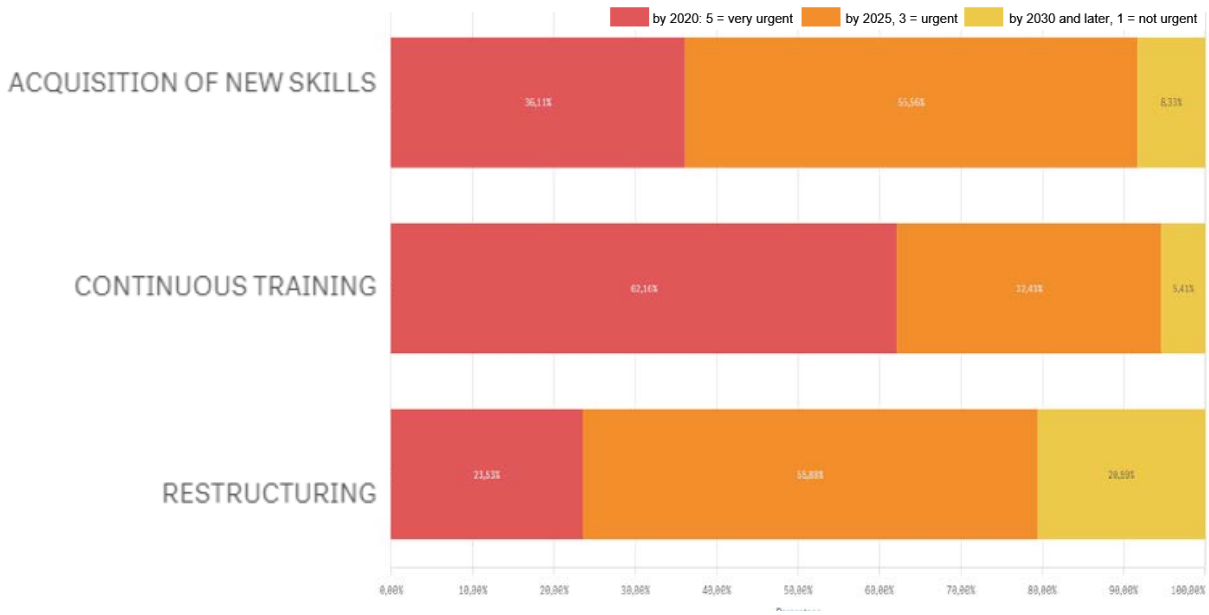

Figure 75: KPI 2.10 (Offer) Drivers of Change – Group STRUCTURAL CHANGES - URGENCY – VET sample

The Responses from VET institutions are broadly aligned with the overall sample results as set out in **Figure 75**. Again "CONTINUOUS TRAINING" has been ranked number one based on the proportion of 'very urgent' responses (62%) , followed by the "ACQUISITION OF NEW SKILLS" (36%). Based on the combined scores for 'very urgent' (score of 5) and 'urgent' (score of 4), "CONTINUOUS TRAINING" is again ranked first (95%), followed by "ACQUISITION OF NEW SKILLS" (92%), and "RESTRUCTURING" (79%).

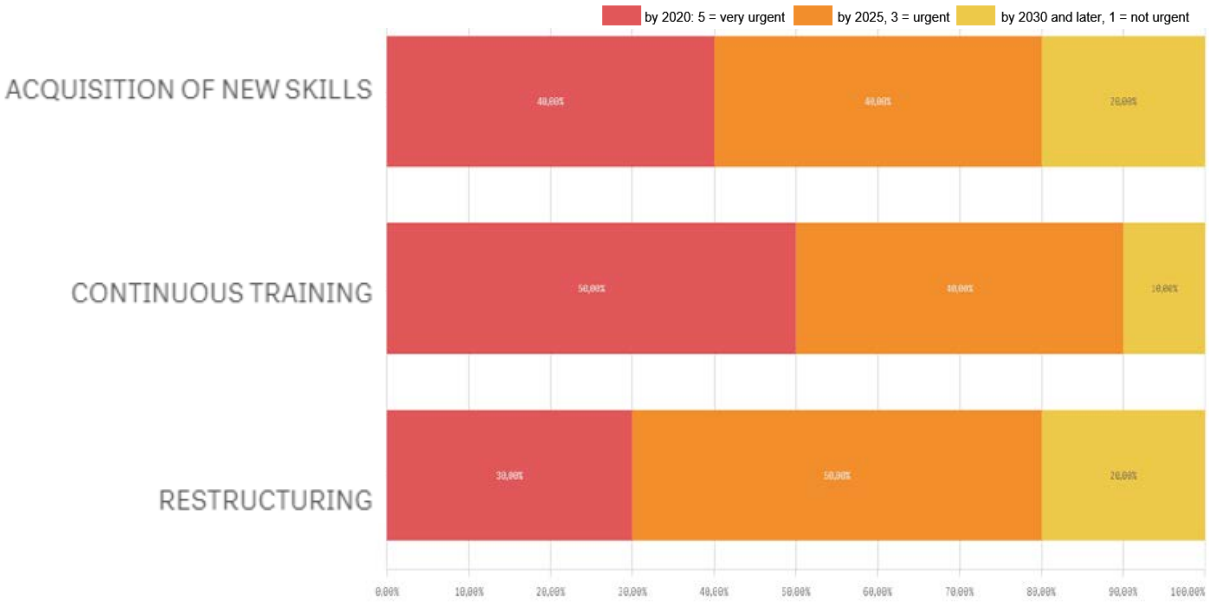

Figure 76: KPI 2.10 (Offer) Drivers of Change – Group STRUCTURAL CHANGES - URGENCY – INSTITUTE sample

The responses from research institutes, accreditation, certification or qualification bodies is also broadly aligned with overall sample results and, based on the proportion of respondents identifying

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the time horizon for action as 'very urgent' (by 2020) are outlined in **Figure 76**. On this basis "CONTINUOUS TRAINING" has been ranked as number one, by 50% of respondents, followed by "ACQUISITION OF NEW SKILLS" (40%). The major difference by comparison with responses from other stakeholders is that when a medium-term time horizon (by 2025) is considered, "RESTRUCTURING" is cited most frequently.

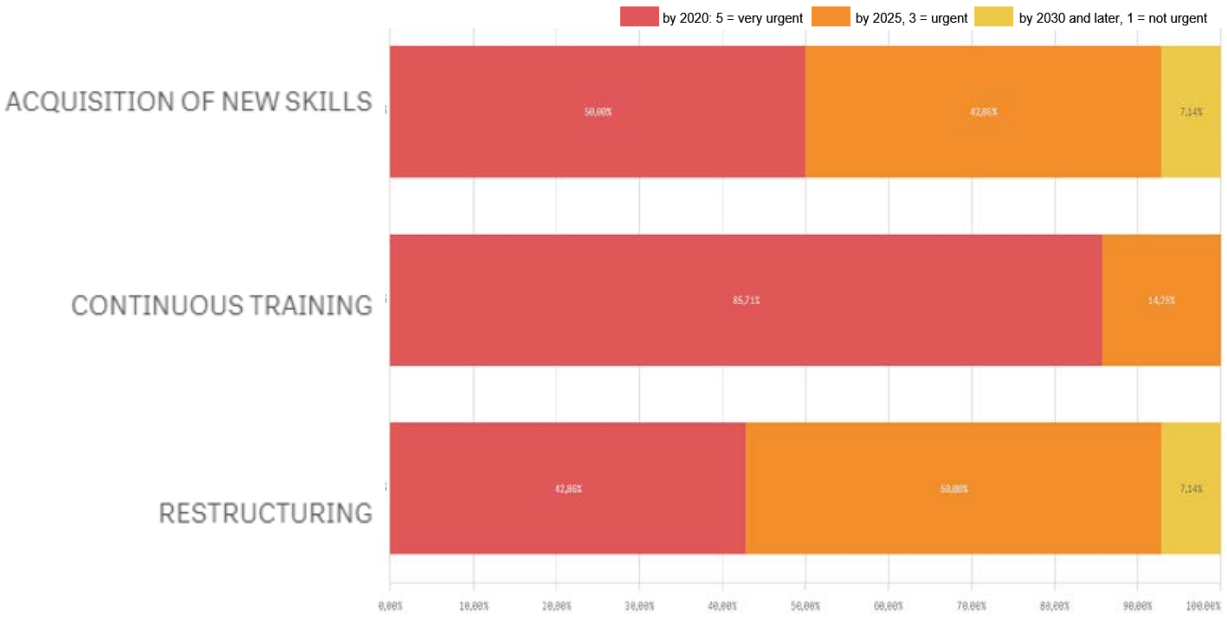

Figure 77: KPI 2.10 (Offer) Drivers of Change – Group STRUCTURAL CHANGES - URGENCY – PRIVATE COMPANY sample

From the perspective of private companies involved in VET delivery (**Figure 77**), not surprisingly "CONTINUOUS TRAINING" is ranked first when the time horizon for action is considered 'very urgent' (85%). If a medium-term time horizon for action is considered (by 2025) the "ACQUISITION OF NEW SKILLS" (43%) and "RESTRUCTURING" (50%) become more important.

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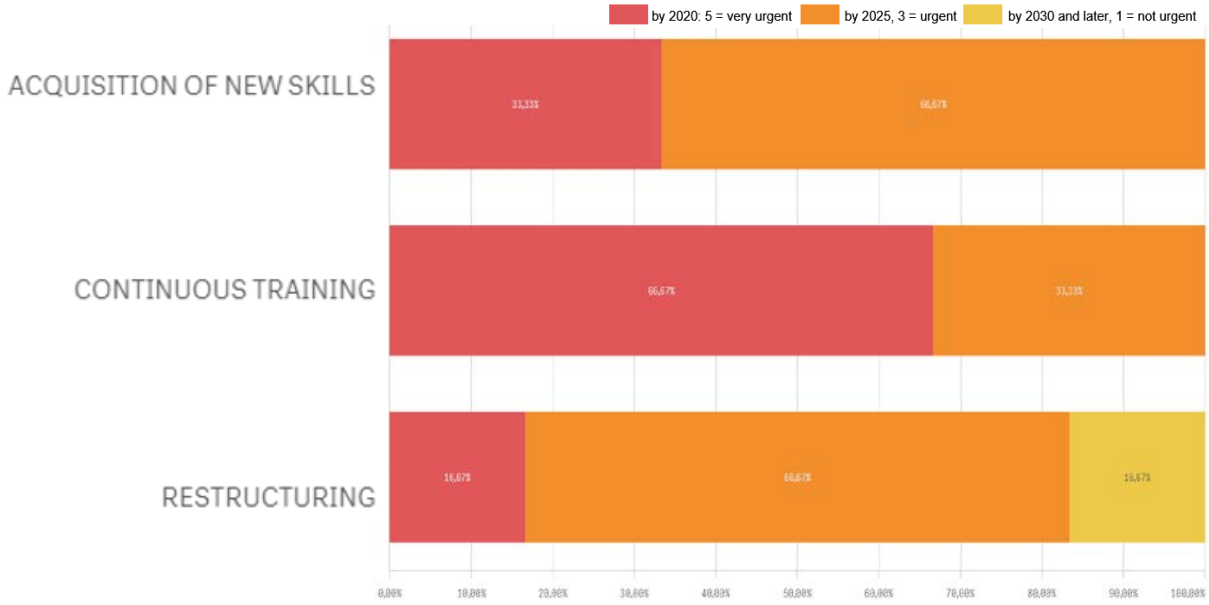

Figure 78: KPI 2.10 (Offer) Drivers of Change – Group STRUCTURAL CHANGES - URGENCY – UMBRELLA ORG. sample

For VET umbrella / international organisations responses broadly mirror those from other stakeholders when the time horizon for action is considered 'very urgent' (**Figure 78**). On this basis, "CONTINUOUS TRAINING" is ranked first (66%). When a medium-term time horizon is considered (by 2025) "ACQUISITION OF NEW SKILLS" and "RESTRUCTURING" becomes more important. This underlines the logic of automotive companies having first to focus on continuous training as demand for this is more immediate, with a focus on restructuring and the acquisition of new skills a slightly longer term priority.

6.2.16 DIFFERENCE BETWEEN DEMAND AND OFFER

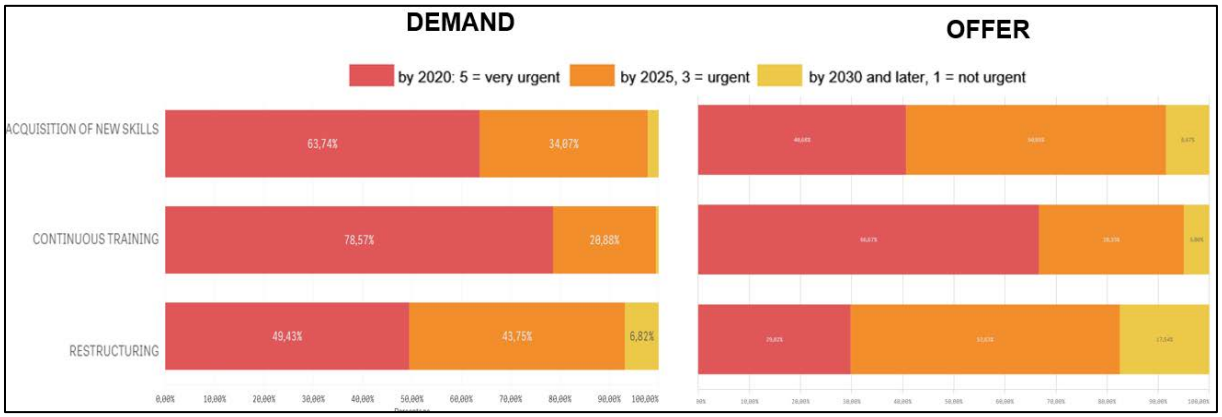

Figure 79: STRUCTURAL CHANGES - URGENCY - comparison between the 2 surveys

The biggest difference between the responses from a Demand and Offer perspective is the somewhat higher urgency attached to tackling the impact of these drivers by automotive companies (**Figure 79**). This is evident with respect to all drivers when 'very urgent' (by 2020) responses are analysed.

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6.2.17 GLOBALISATION AND RISE OF NEW PLAYERS

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

Individual Drivers of Change in this category are:

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

- **Global regulatory dialogue**
  The EU Single Market is a key element for the maintenance of EU competitiveness. Future advantages are likely to be linked to increased standardisation between member states. It is evident that such processes cannot be put in place by social partners or industry alone; the Commission and in general, Governments and public administrations will need to play a fundamental role in the elaboration of policies and strategies that will support the competitiveness of the European Automotive sector.
- **Access to raw materials**
  In a disruptive scenario, activities linked to raw materials become critical, especially if some resources (limited in terms of quantity or geographical presence) are necessary to produce key components. From this point of view, the automotive sector will need to develop sourcing strategies to ensure a stable supply of critical and key raw materials (eg. Lithium) to insulate them from the risk of shortages and potential price spikes. Also, the importance of supporting the circular economy by finding ways to improve the supply chain and resource efficiencies

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and finding better methods to reuse and recycle materials will require the necessary skilled people to meet these technology requirements.

7.2.1.1. Globalisation and Rise of New Players: Importance

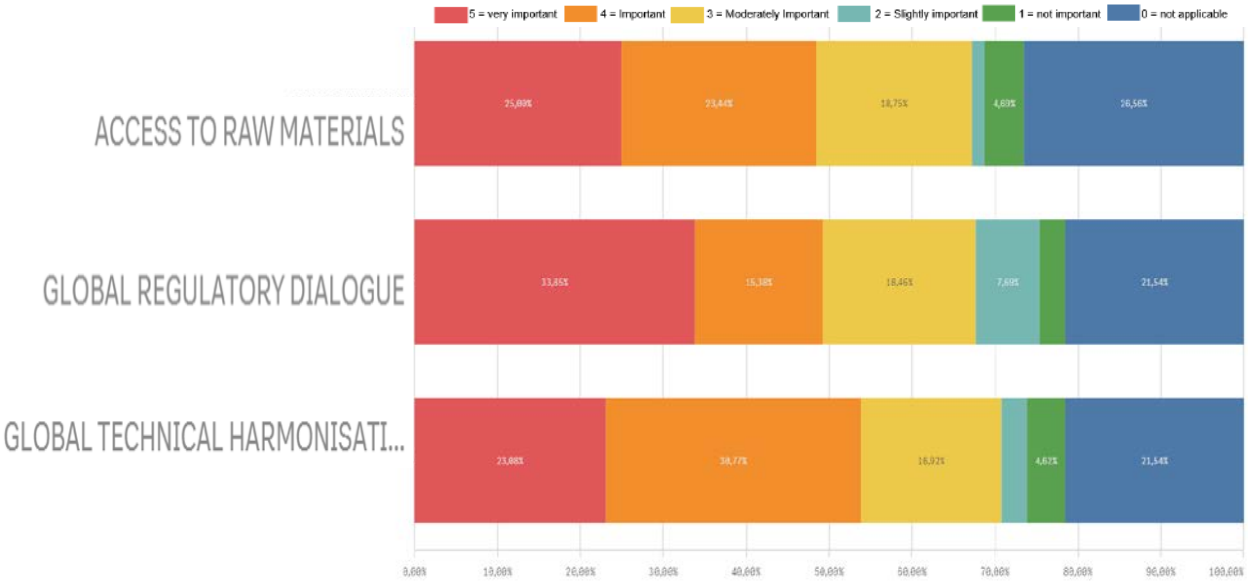

Figure 80: KPI 2.11 (Offer): Drivers of Change – Group GLOBALISATION AND RISE OF NEW PLAYERS: IMPORTANCE – Overall sample

Figure 80 sets out analysis of the relative importance of each Driver of Change within the "GLOBALISATION AND RISE OF NEW PLAYERS" category, based on responses to the 'offer' survey from all stakeholders. The role of Governments and public administrations in the elaboration of policies and strategies, to support the competitiveness of the European Automotive sector is considered the most important driver of change, as "GLOBAL REGULATORY DIALOGUE" is ranked first, based on responses with a score of 5, followed by "ACCESS TO RAW MATERIALS", ranked second, and "GLOBAL TECHNICAL HARMONISATION", third. However, the proportion of scores 3 and above is higher for "GLOBAL TECHNICAL HARMONISATION", with nearly 71% of the respondents, followed by "GLOBAL REGULATORY DIALOGUE" (68%) and "ACCESS TO RAW MATERIALS" (67%). It is important to mention the significant percentage of "Not applicable" responses: 22% for "GLOBAL TECHNICAL HARMONISATION" and "GLOBAL REGULATORY DIALOGUE" and 27% for "ACCESS TO RAW MATERIALS".

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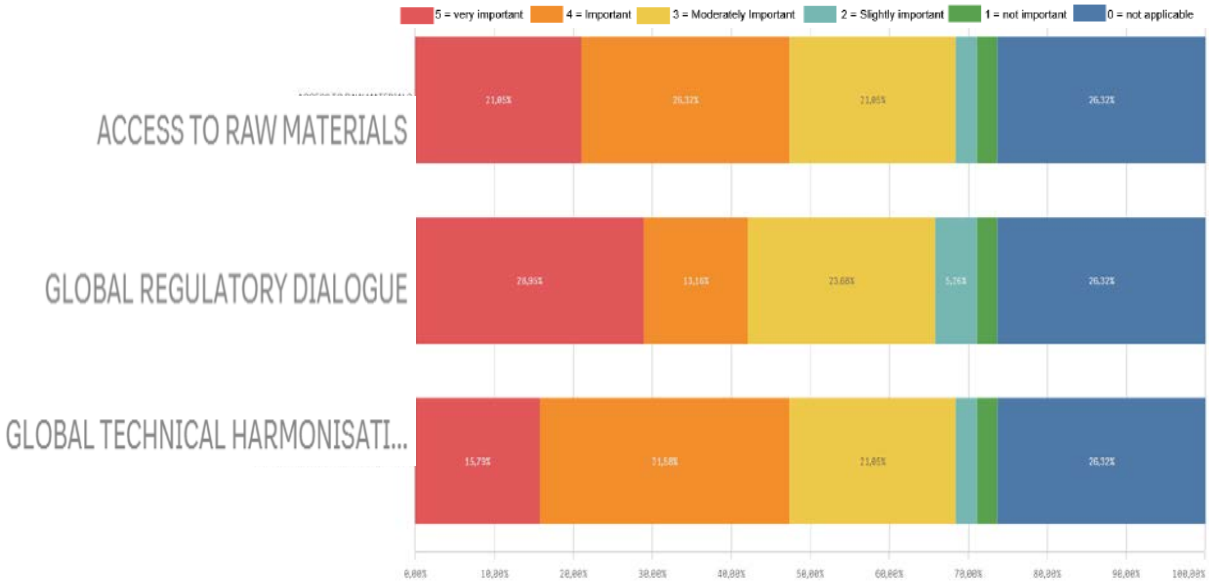

Figure 81: KPI 2.11 (Offer): Drivers of Change – Group GLOBALISATION AND RISE OF NEW PLAYERS: IMPORTANCE – VET sample

Figure 81 outlines the responses of VET centres. The results for the most important driver of change, responses with a score of 5, show a pattern similar to the results of the whole sample: "GLOBAL REGULATORY DIALOGUE" is ranked first, followed by "ACCESS TO RAW MATERIALS", ranked second, and "GLOBAL TECHNICAL HARMONISATION", third. However, "GLOBAL TECHNICAL HARMONISATION" and "ACCESS TO RAW MATERIALS" show the same proportion of scores above 3 (68%), whereas "GLOBAL REGULATORY DIALOGUE" is cited less frequently (66%). Again, there are a significant percentage of "Not applicable" responses: 26% in the three specific drivers of change considered.

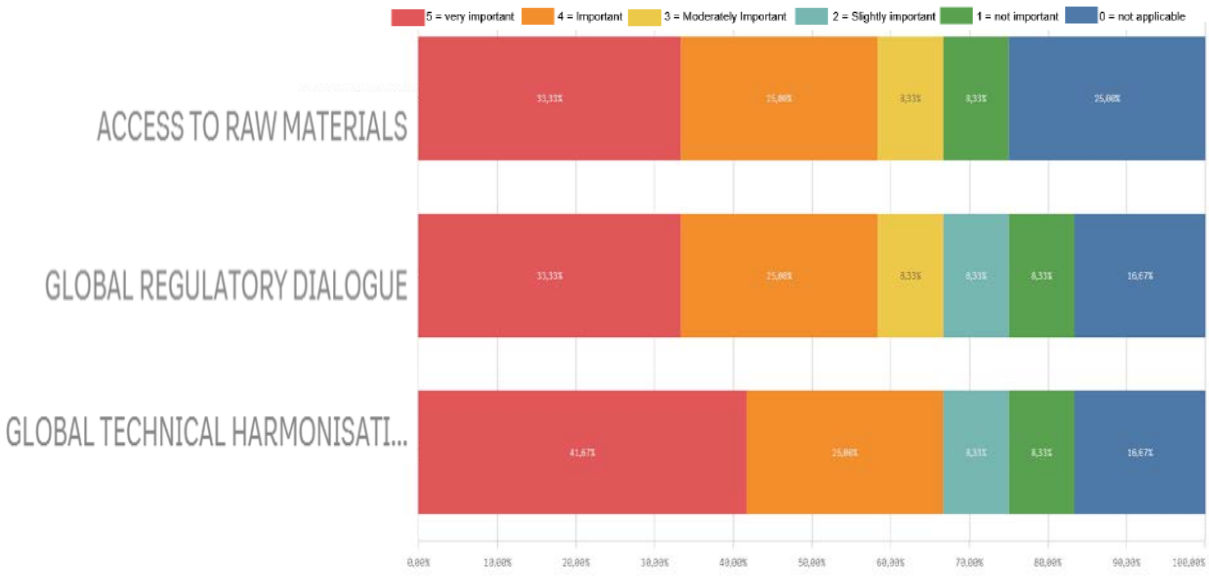

Figure 82: KPI 2.11 (Offer): Drivers of Change – Group GLOBALISATION AND RISE OF NEW PLAYERS: IMPORTANCE – INSTITUTE sample

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Responses of Institutes are set out in **Figure 82**. In this case, the "GLOBAL TECHNICAL HARMONISATION" is ranked first as most important driver of change, with 42% of responses with a score of 5, and 67% with a score of 4 or above, whereas "ACCESS TO RAW MATERIALS" and the "GLOBAL REGULATORY DIALOGUE" had the same number of responses: 33% with a score of 5 and 58% with score 4 or higher. In this case, the percentage of "Not applicable" responses was higher for "ACCESS TO RAW MATERIALS" (25%), than for the two other drivers of change "GLOBAL TECHNICAL HARMONISATION" and "GLOBAL REGULATORY DIALOGUE" (17% in both cases).

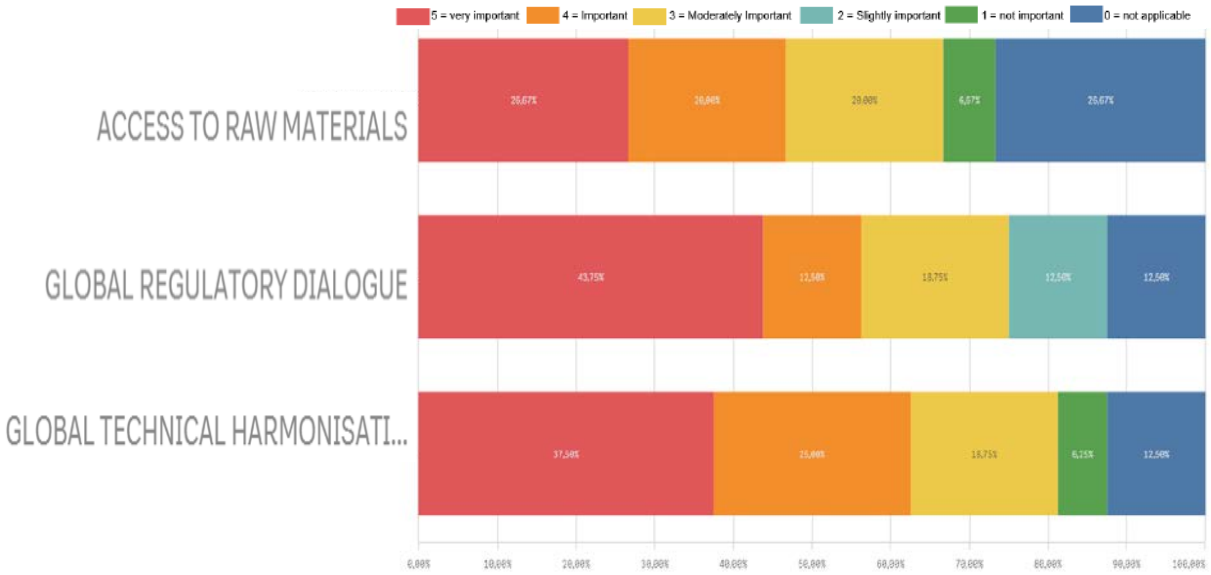

Figure 83: KPI 2.11 (Offer): Drivers of Change – Group GLOBALISATION AND RISE OF NEW PLAYERS: IMPORTANCE – PRIVATE COMPANY sample

As outlined in **Figure 83**, responses of private companies point to a somewhat different pattern: "GLOBAL REGULATORY DIALOGUE" was ranked first, when responses with a score of 5 are considered (44%), followed by "GLOBAL TECHNICAL HARMONISATION", ranked second (37%), and "ACCESS TO RAW MATERIALS", third (27%). However, "GLOBAL TECHNICAL HARMONISATION" had a higher proportion of responses with a score above 3 (81%), followed by "GLOBAL REGULATORY DIALOGUE" (75%) and "ACCESS TO RAW MATERIALS" (67%).

In this case, the percentage of "Not applicable" responses was higher for "ACCESS TO RAW MATERIALS" (27%), than for the two other drivers of change "GLOBAL TECHNICAL HARMONISATION" and "GLOBAL REGULATORY DIALOGUE" (12% in both cases).

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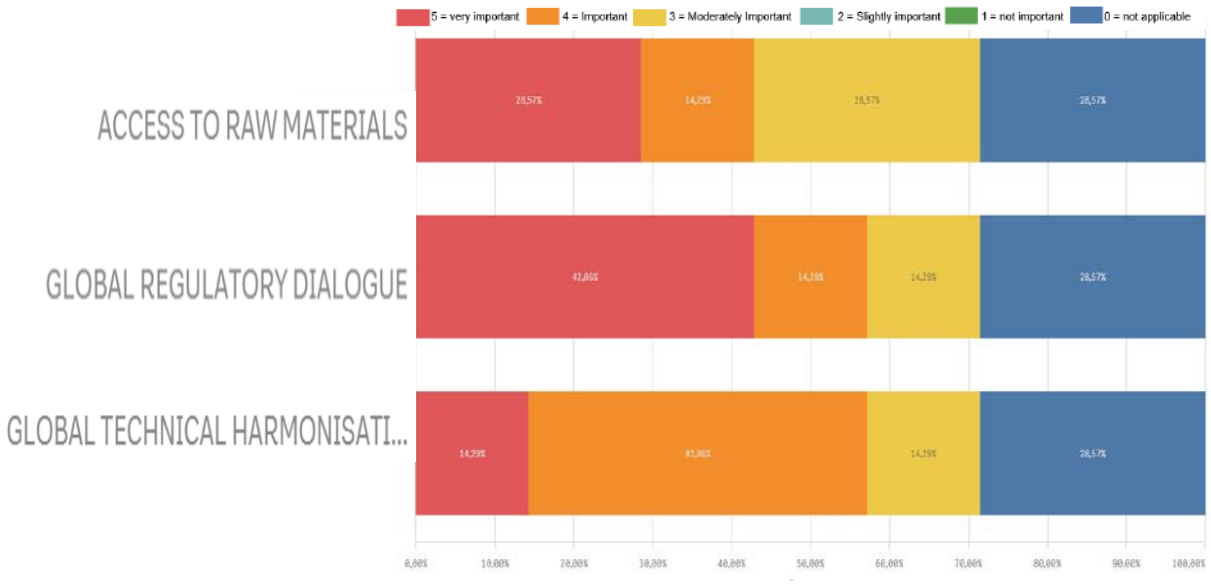

Figure 84: KPI 2.11 (Offer): Drivers of Change – Group GLOBALISATION AND RISE OF NEW PLAYERS: IMPORTANCE – UMBRELLA ORG. sample

Responses of umbrella organisations, as set out in **Figure 84**, differs from responses from other stakeholders. "GLOBAL REGULATORY DIALOGUE" is again ranked first, when responses with a score of 5 are considered (43%) with "ACCESS TO RAW MATERIALS" ranked second (29%) and "GLOBAL TECHNICAL HARMONISATION", third with only 14%. However, when scores 4 or above are considered, both "GLOBAL TECHNICAL HARMONISATION" and "GLOBAL REGULATORY DIALOGUE" are the same in terms of the number of responses (57%), with the three drivers of change equal in terms of the proportion of responses if scores above 3 are taken into account (71%). In this case, the percentage of "Not applicable" responses is the same (29%) for the three specific drivers of change.

6.2.18 DIFFERENCE BETWEEN DEMAND AND OFFER

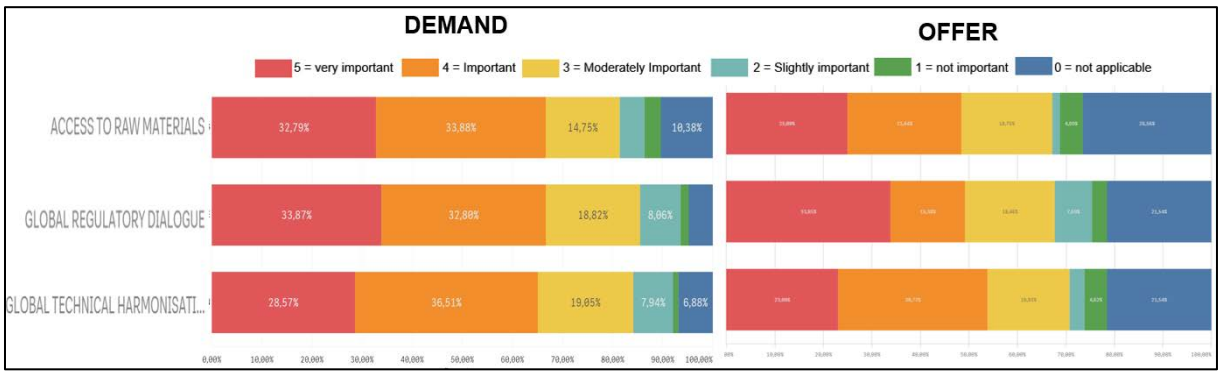

Figure 85: GLOBALISATION AND RISE OF NEW PLAYERS – IMPORTANCE - comparison between the 2 surveys

The main difference when the Demand and Offer surveys are compared (**Figure 85**), is the larger percentage of "Not applicable" answers with respect to most drivers in the case of offer survey respondents.

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In relation to the three individual Drivers of Change, “GLOBAL REGULATORY DIALOGUE” is ranked first by the whole sample in both cases (Demand and Offer), and “ACCESS TO RAW MATERIALS”, ranked second, although the importance attached from a demand perspective is somewhat higher than is the case from the Offer perspective.

7.2.1.2. Globalisation and Rise of New Players: Urgency

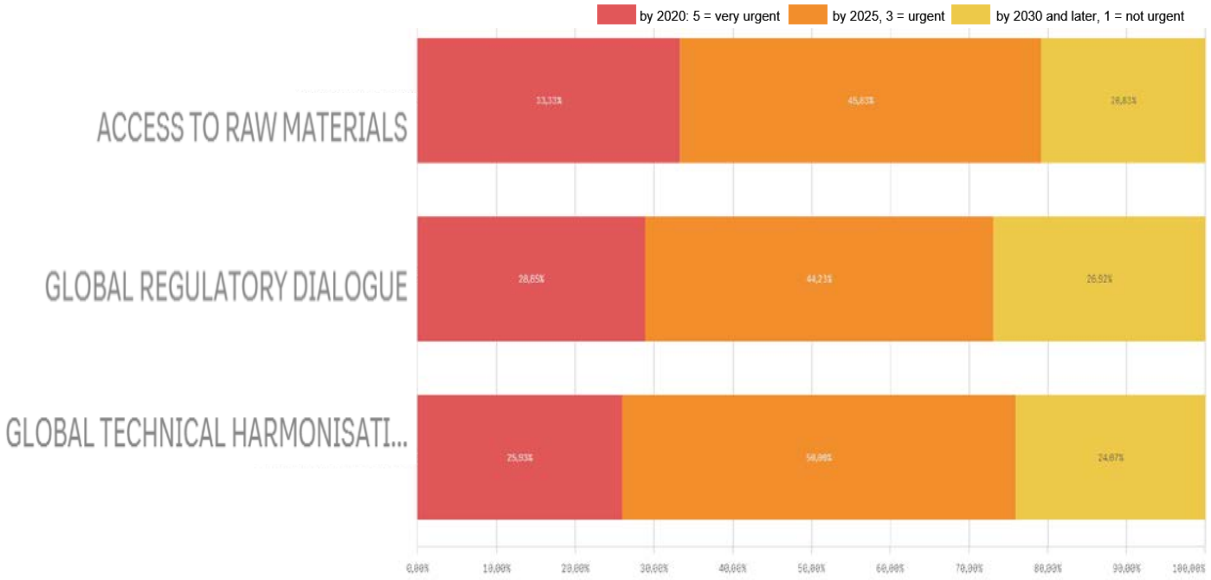

Figure 86: KPI 2.12 (Offer) Drivers of Change – Group GLOBALISATION AND RISE OF NEW PLAYERS - URGENCY – Overall sample

Figure 86 shows the relative urgency of the drivers of change included in the group “GLOBALISATION AND RISE OF NEW PLAYERS”, as indicated by all respondents. The most relevant time period for the three drivers of change is “by 2025”, with 44-50% of responses. The percentage of less urgent responses (by 2030 or later) ranges from 21 to 27%.

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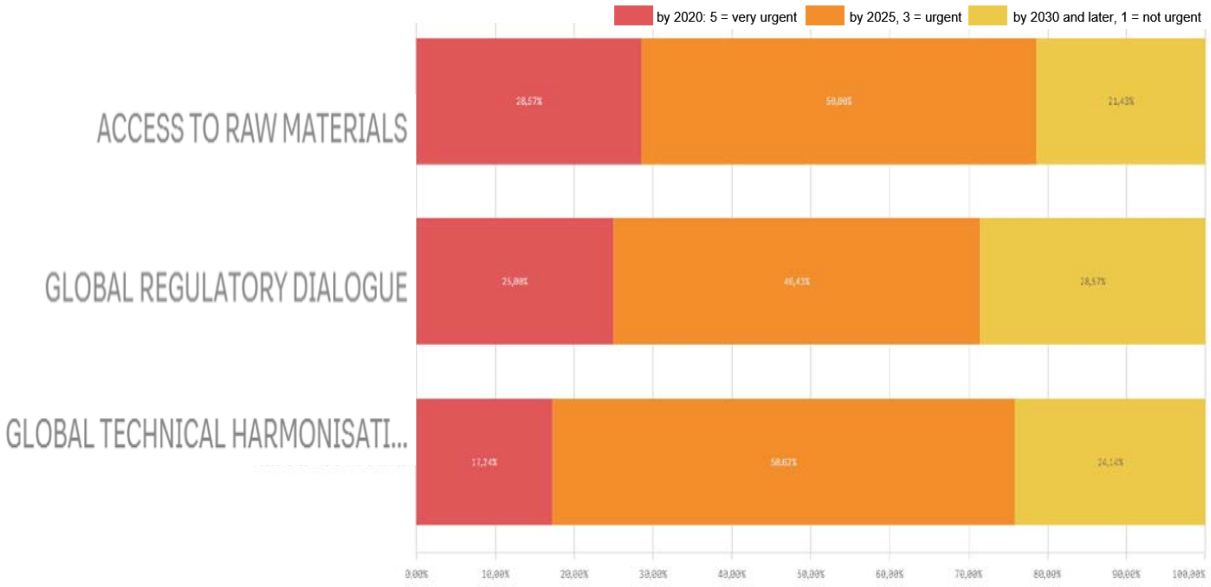

Figure 87: KPI 2.12 (Offer) Drivers of Change – Group GLOBALISATION AND RISE OF NEW PLAYERS - URGENCY – VET sample

The responses of the VET centres sample, shown in **Figure 87**, follows a similar to that of the whole sample, although proportion of respondents pointing to the need for shorter term action (very urgent - by 2020) are lower and the proportion indicating the need for medium-term responses (by 2025) higher than for the overall sample.

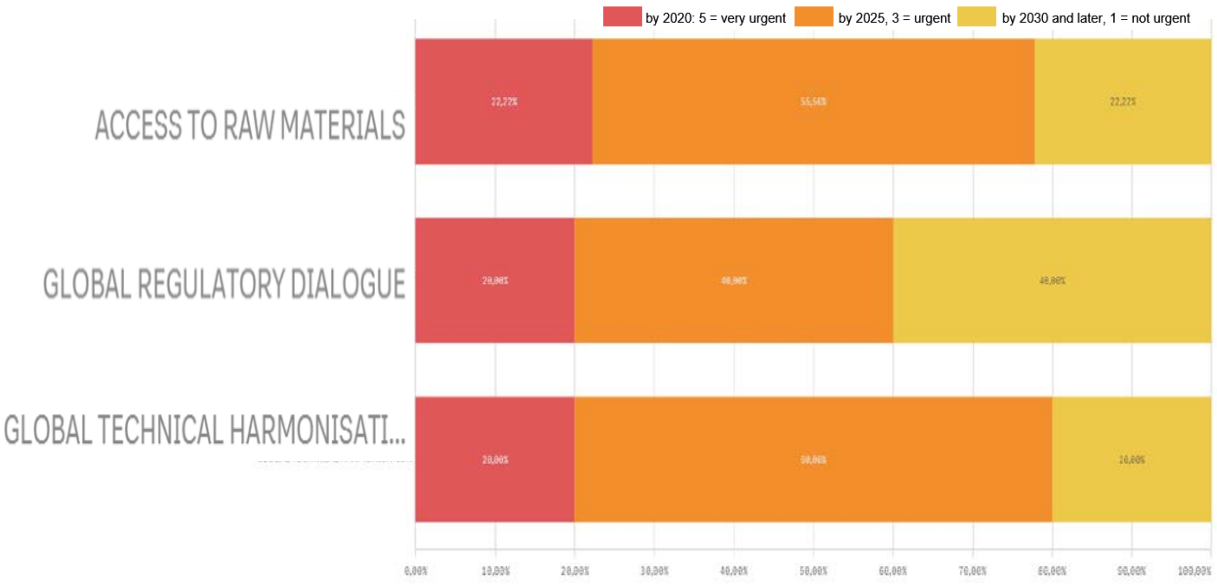

Figure 88: KPI 2.12 (Offer) Drivers of Change – Group GLOBALISATION AND RISE OF NEW PLAYERS - URGENCY – INSTITUTE sample

Responses for the Institutes sample is outlined in **Figure 88**, and also points to a longer-term time horizon for action, particularly in the case of the "GLOBAL REGULATORY DIALOGUE" driver of change, for which 40% of respondents assigned the lowest urgency score.

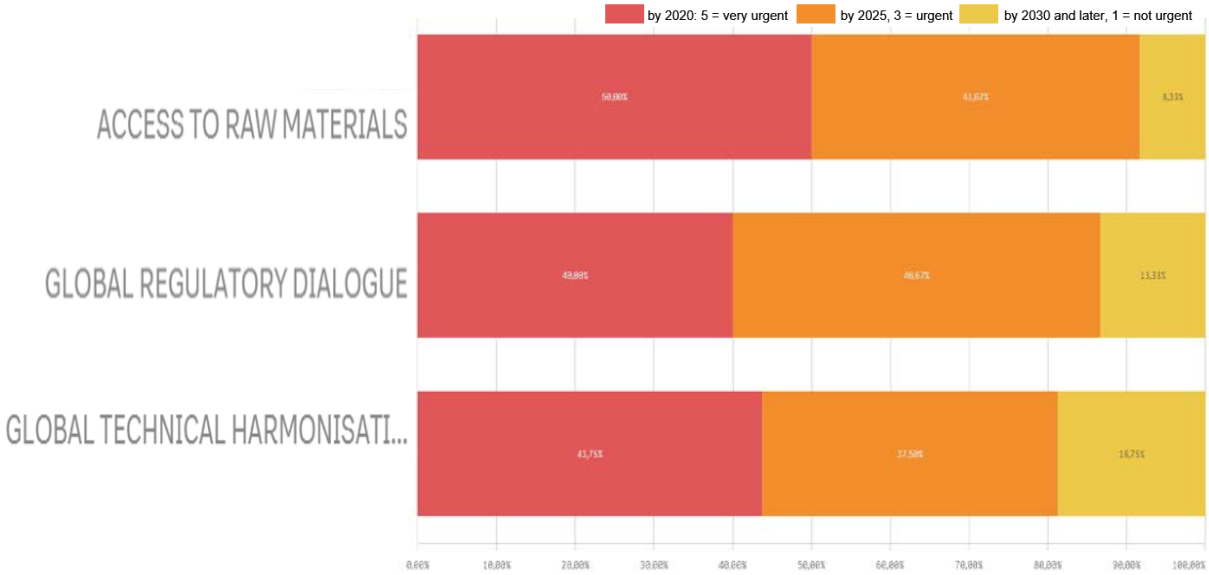

Figure 89: KPI 2.12 (Offer) Drivers of Change – Group GLOBALISATION AND RISE OF NEW PLAYERS - URGENCY – PRIVATE COMPANY sample

As shown in **Figure 89**, private companies are more likely to assign the highest urgency levels to the three drivers of change, particularly "ACCESS TO RAW MATERIALS" (50% responses with the highest urgency score, "by 2020") and "GLOBAL TECHNICAL HARMONISATION" (44% "by 2020"). These stakeholders are also less likely to assign "not urgent" scores, by comparison with the whole sample and other stakeholders (Under 20% for each of the three drivers of change considered).

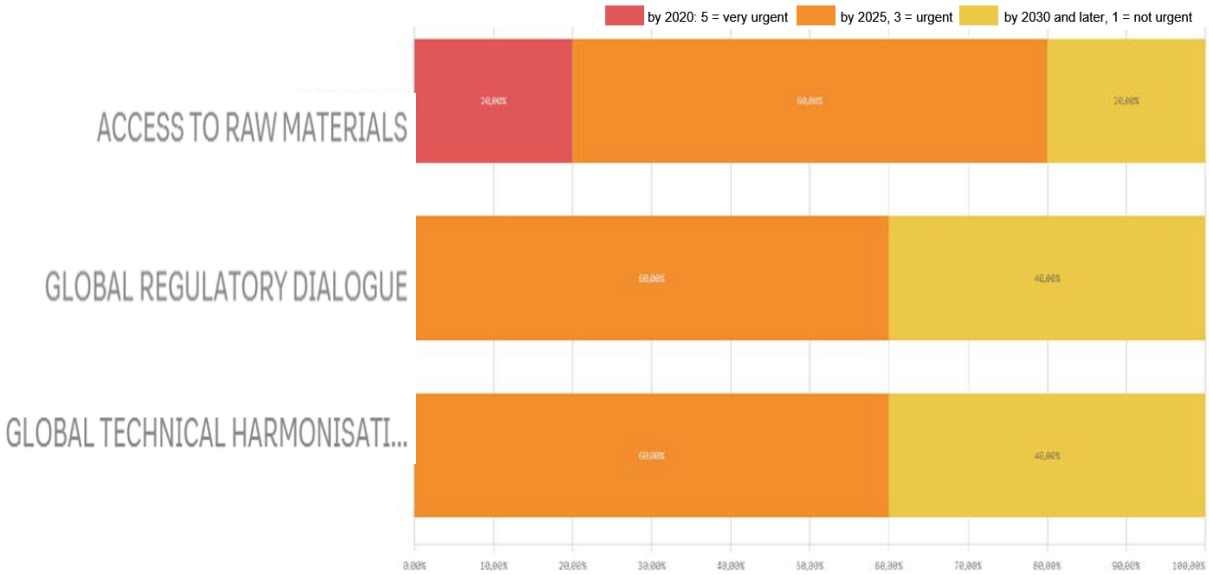

Figure 90: Figure 122: KPI 2.12 (Offer) Drivers of Change – Group GLOBALISATION AND RISE OF NEW PLAYERS - URGENCY – UMBRELLA ORG. sample

As outlined in **Figure 90**, umbrella organisations have the lowest urgency scores out of all stakeholders. "ACCESS TO RAW MATERIALS" was considered the most urgent driver of change, the only one with any responses pointing to a 'very urgent' need for action (20%). The other drivers of change "GLOBAL

REGULATORY DIALOGUE" and "GLOBAL TECHNICAL HARMONISATION" were considered of very low urgency (by 2030 or later) by 40% of respondents in each case.

6.2.19 DIFFERENCE BETWEEN DEMAND AND OFFER

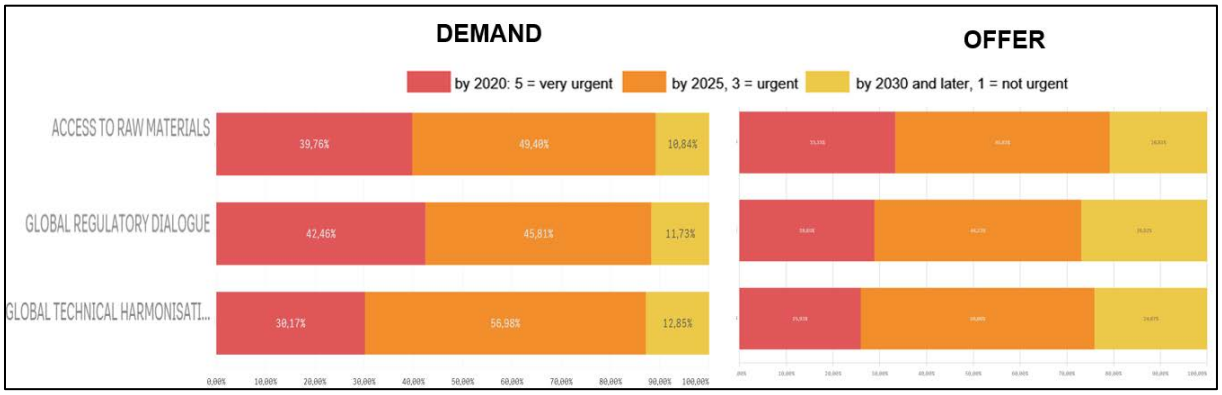

Figure 91: GLOBALISATION AND RISE OF NEW PLAYERS - URGENCY - comparison between the 2 surveys

There is a clear difference in the level of urgency assigned to the Drivers of Change related to regulatory and technical harmonisation, globalisation and access to raw materials by Demand and Offer stakeholders (**Figure 91**). As a group, around 90% of respondents to the demand survey assign high and medium urgency levels ("by 2020" and "by 2025" respectively), whereas with respect to the offer survey respondents, high and medium urgency levels represent around 75% of all responses, with a clear difference between the public offer (VET, institutes, umbrella organisations) and the private companies involved in VET delivery. The responses of the latter are more similar to the Demand results.

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6.2.20 DRIVER OF CHANGE PRIORITY INDEX

The creation of an index to combine 'importance' and 'urgency' criteria for each Driver of Change is essential in order to develop an overall priority index that provides a simple ranking of responses relating to different stakeholders vision of the sector.

In a simplified form, the DoC PRIORITY INDEX is stated as:

Priority (1 to 5) **x Timeframe** (2020=5, 2025=3, 2030 and further=1).

A more precise formula is as follows:

$$\text{PRIORITY DoC INDEX} = \sum_{i=1}^{n} DoC\,[priority]_i * DoC[urgency]_i$$

Where:

i = number of replies to the questionnaire

DoC [priority]$_i$ = score attributed to i DoC in the priority section, with a scale:

- 0 = not applicable
- 1 = not important
- 2 = Slightly important
- 3 = Moderately Important
- 4 = Important
- 5 = very important

DoC [urgency]$_i$ = score attributed to i DoC in the urgency section with a scale:

- by 2020: 5 = very urgent
- by 2025, 3 = urgent
- by 2030 and later, 1 = not urgent

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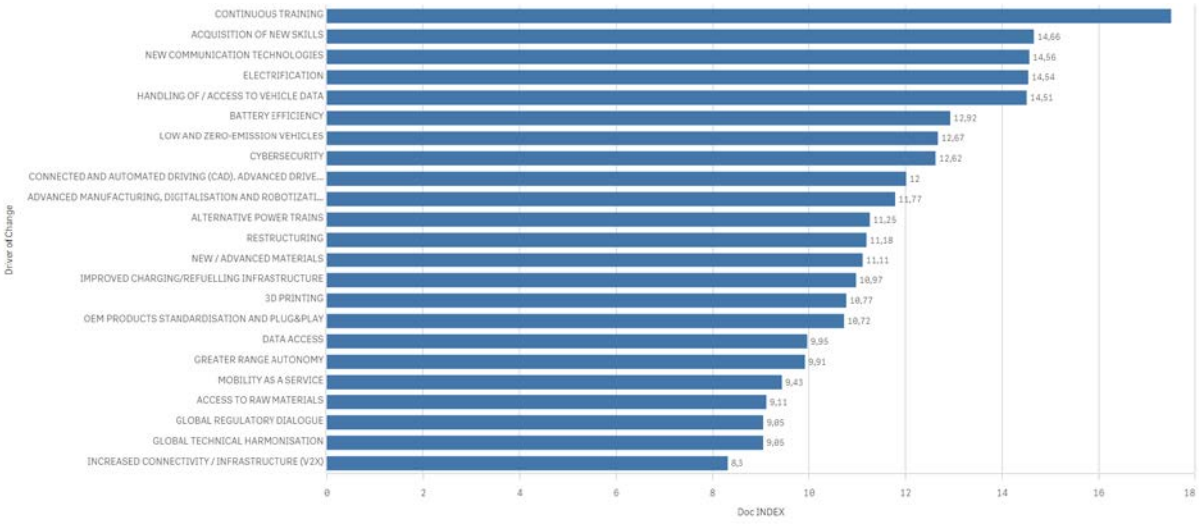

Figure 92 KPI 2.13 (Offer) Drivers of Change – Priority Index – Overall sample

Figure 92 shows the overall PRIORITY DoC INDEX where „CONTINUOUS TRAINING“ is ranked as the key Driver of Change measured on this basis. This is followed by a cluster of 4 Drivers of Change with minimal differences in overall scores. „ACQUISITION OF NEW SKILLS“, „NEW COMMUNICATION TECHNOLOGIES“, „ELECTRIFICATION“ and „HANDLING OF / ACCESS TO VEHICLE DATA“ reflect the importance of understanding technological changes in the automotive sector in order to respond effectively to upskilling and reskilling challenges.

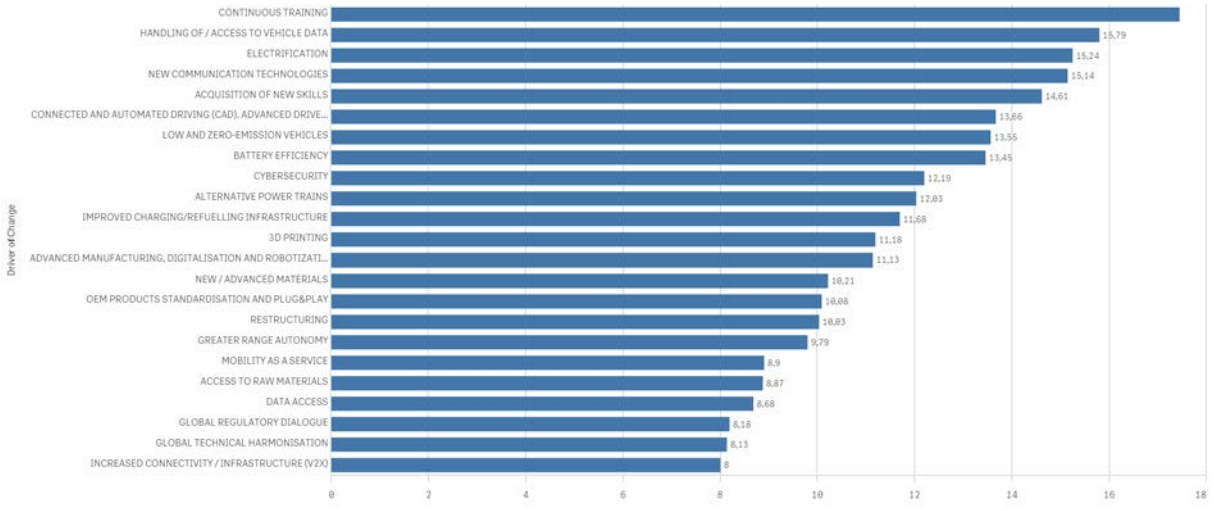

Figure 93: KPI 2.13 (Offer) Drivers of Change – Priority Index – VET sample

Looking now at the PRIORITY DoC INDEX purely in relation to VET respondents, **Figure 93** indicates that VET responses closely mirror those from all stakeholders. With one exception the same TOP10 Drivers of Change are identified. Unlike the responses from all stakeholders, from the perspective of VET providers “ACQUISITION OF NEW SKILLS” has moved to 5th place beyond “HANDLING OF / ACCESS TO

VEHICLE DATA'", "ELECTRIFICATION" and "NEW COMMUNICATION TECHNOLOGIES". "ADVANCED MANUFACTURING, DIGITALIZATION AND ROBOTIZATION OF THE MANUFACTURING PROCESS" falls out of the list for the TOP10 and has been replaced by "ALTERNATIVE POWER TRAINS".

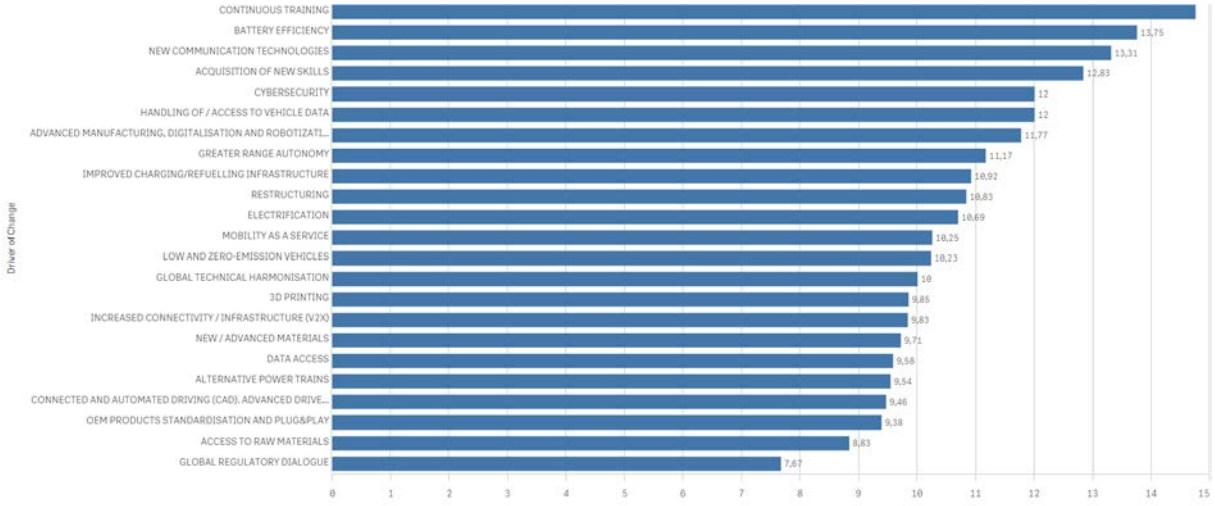

Figure 94: KPI 2.13 (Offer) Drivers of Change – Priority Index – INSTITUTE sample

Figure 94 outlines the PRIORITY DoC INDEX by applying the same analysis for INSTITUTES. On this basis, "CONTINUOUS TRAINING" and "BATTERY EFFICIENCY" are the first two priority Drivers of Change, with "NEW COMMUNICATION TECHNOLOGIES" ranked third. „ACQUISITION OF NEW SKILLS" and „CYBERSECURITY" are ranked fifth and sixth respectively. "ELECTRIFICATION" and "LOW AND ZERO-EMISSION VEHICLES" fall out of TOP 10. "GREATER RANGE AUTONOMY" and "IMPROVED CHARGING/REFUELLING INFRASTRUCTURE" are also identified as high priority DoCs, reflecting the importance and urgency attached to these by INSTITUTE's, as set out previously.

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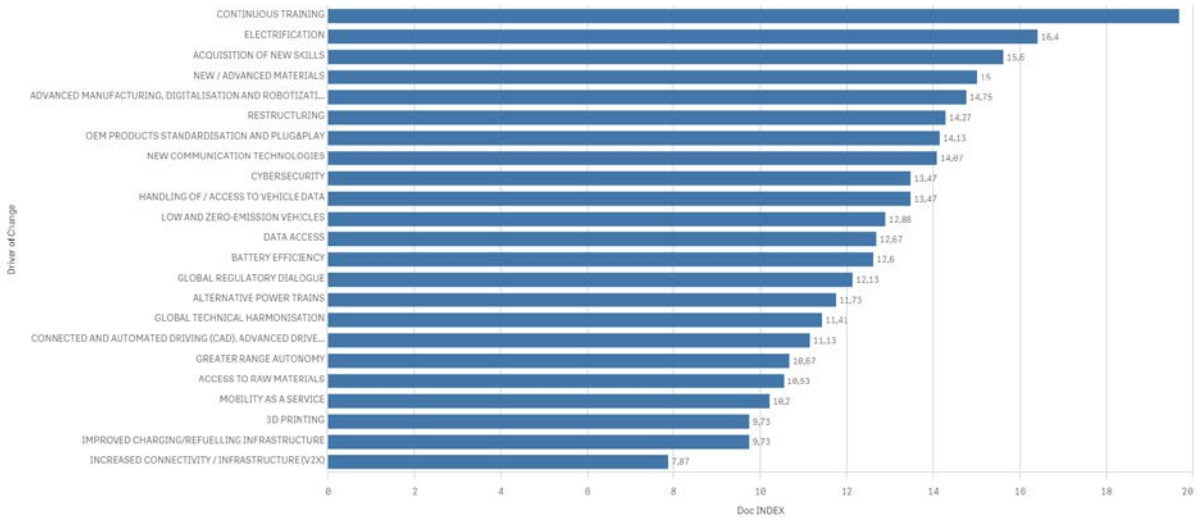

Figure 95: KPI 2.13 (Offer) Drivers of Change – Priority Index – PRIVATE COMPANY sample

Figure 95 outlines the PRIORITY DoC INDEX in relation to PRIVATE COMPANY stakeholders who are VET providers. „CONTINUOUS TRAINING“, „ELECTRIFICATION“ and „ACQUISITION OF NEW SKILLS“ are the first three priority Drivers of Change. By comparison with the overall sample, VET stakeholders and INSTITUTE's a slightly different pattern of responses emerges, with „NEW / ADVANCED MATERIALS“, „RESTRUCTURING“, „OEM PRODUCTS STANDARDISATION AND PLUG&PLAY“ now appearing in the list of the TOP10. By contrast, "BATTERY EFFICIENCY" and "LOW AND ZERO-EMISSION VEHICLES" falls out of the TOP10. This could be linked to the need for more tangible solutions and necessity to react quickly to changing requirements of the VET market.

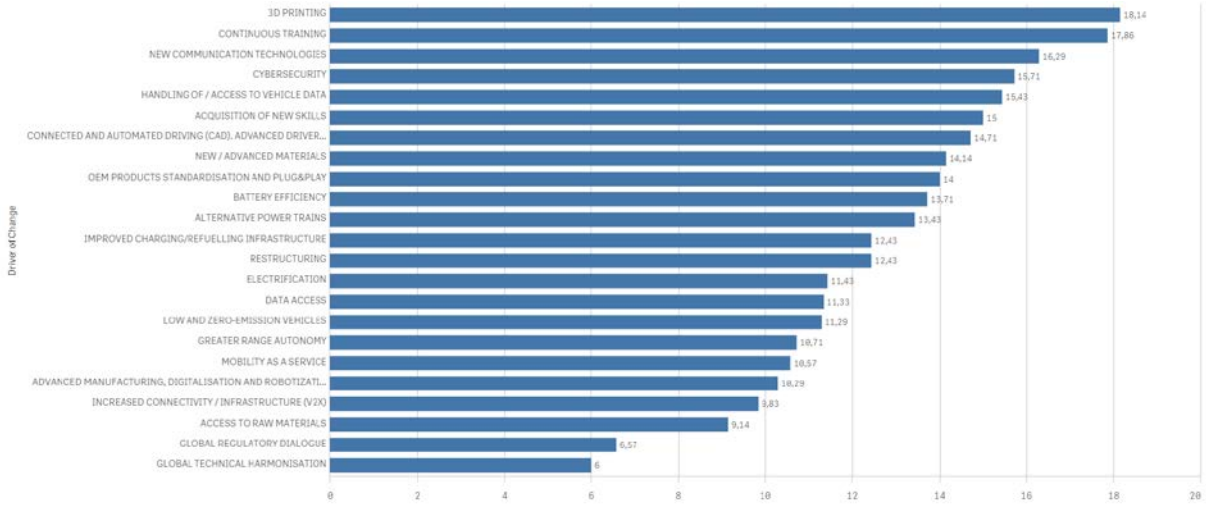

Figure 96: Figure 131: KPI 2.13 (Offer) Drivers of Change – Priority Index – UMBRELLA ORG. sample

Applying the same analysis for UMBRELLA ORGANISATIONS, the PRIORITY DoC INDEX is outlined in **Figure 96**. The Index indicates „3D PRINTING“ is ranked first , with „CONTINUOUS TRAINING“ and

„ACQUISITION OF NEW SKILLS“ second and third respectively. Together with PRIVATE COMPANY and UMBRELLA stakeholders „NEW / ADVANCED MATERIALS“ and „OEM PRODUCTS STANDARDISATION AND PLUG&PLAY“ are identified as priority Drivers of Change. „ELECTRIFICATION” and „LOW AND ZERO-EMISSION VEHICLES” are also identified as low priority, similar to responses from INSTITUTEs.

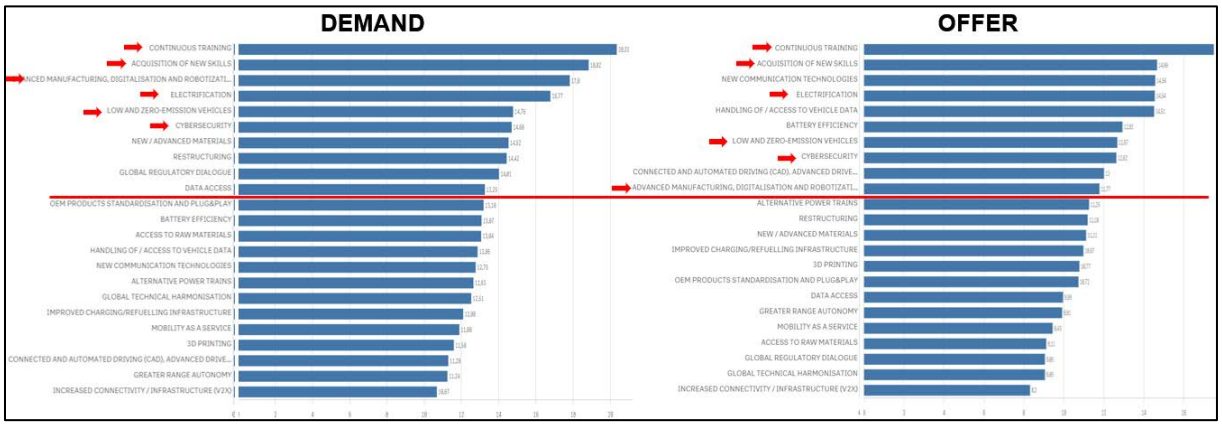

Figure 97: DoC Priority Index comparison at TOP 10 between the 2 surveys

Figure 97 shows a comparison of the overall Offer and Demand shows that “CONTINUOUS TRAINING” and “ACQUISITION OF NEW SKILLS” are ranked as the first two priority Drivers of Change for both point of view. This result is particularly important for the DRIVES project as the necessity for upskilling and reskilling is a priority for the sector, but also a central objective of the DRIVES project itself. Looking at the TOP 10, both from the perspective of the Offer and Demand, these coincide in a total of 6 DoCs, in addition to the “ADVANCED MANUFACTURING, DIGITALIZATION AND ROBOTIZATION OF THE MANUFACTURING PROCESS“, „LOW AND ZERO-EMISSION VEHICLES“ and „CYBERSECURITY“ . Focussing still on the TOP 10, from the perspective of Demand a higher priority is assigned to “NEW / ADVANCED MATERIALS”, “RESTRUCTURING” “GLOBAL REGULATORY DIALOGUE” and “DATA ACCESS”. From the perspective of the Offer the TOP 10 attaches greater importance to “BATTERY EFFICIENCY”, “NEW COMMUNICATION TECHNOLOGY” and “HANDLING OF/ ACCESS TO VEHICLE DATA”.

6.3 SKILLS

5 main categories or clusters of skills have been identified from previous demand-survey normalisation activity: 4 of these being “technical” and the 5th related to previously identified “soft skills”. Specific job roles comprise different combinations of these skills. (Refer to CHAPTER 6.4 for more details).

Based on replies and normalisation activity undertaken in relation to the previous questionnaire[34] (Demand) identified skills have been ranked using an index.

In a simplified form, the SKILLS INDEX is stated as:

Occurence (of each skill) **x Priority DoC Index** (average for each skill[35])

A more precise formula is stated as:

$$\text{Skills Index} = \sum_{i=1}^{n} Skill\ [occurence]_i * AVG\ DoC\ priority\ index_i$$

Where:

i = number of responses to the questionnaire

Skill [occurrence]$_i$ = number of times the *i skill* has been mentioned

AVG DoC priority index$_i$ = the average of the priority DoC index linked to the *Skill*$_i$ identified by the respondent

With this index it was possible to merge two important sets of information and present this as one number: specifically, how many times a skill has been mentioned in relation to the linked Driver of Change, ranked within one index.

A complete list of SKILLS addressed through available provision taught on an annual basis (Based on outcomes from the offer survey) is available in APPENDIX A.

[34] *Deliverable D2.7 Forecasting dissemination Report, DRIVES Project, www.project-drives.eu*

[35] *Respondents were given the opportunity to indicate for each Skill, the related Drivers of Change interacting with this skill. With this index it is possible to link skills with appropriate Drivers of Change*

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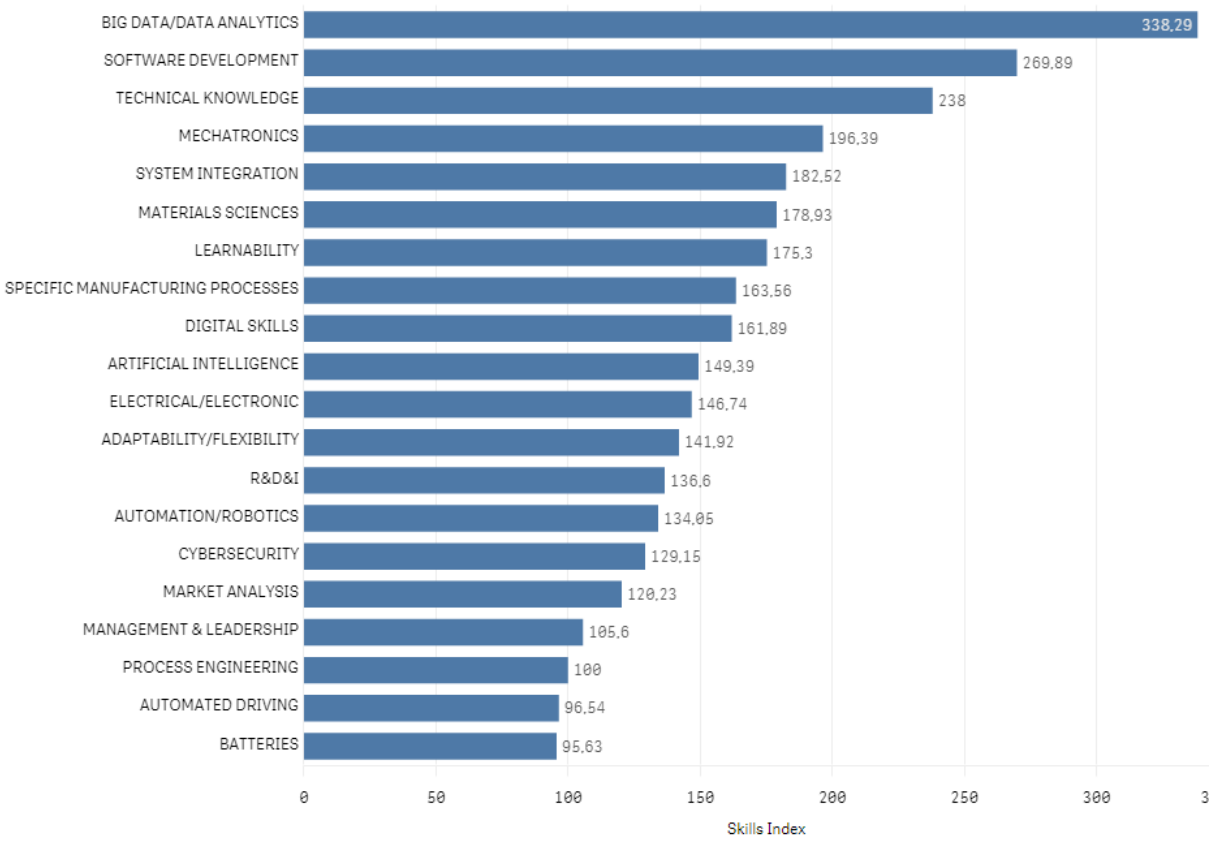
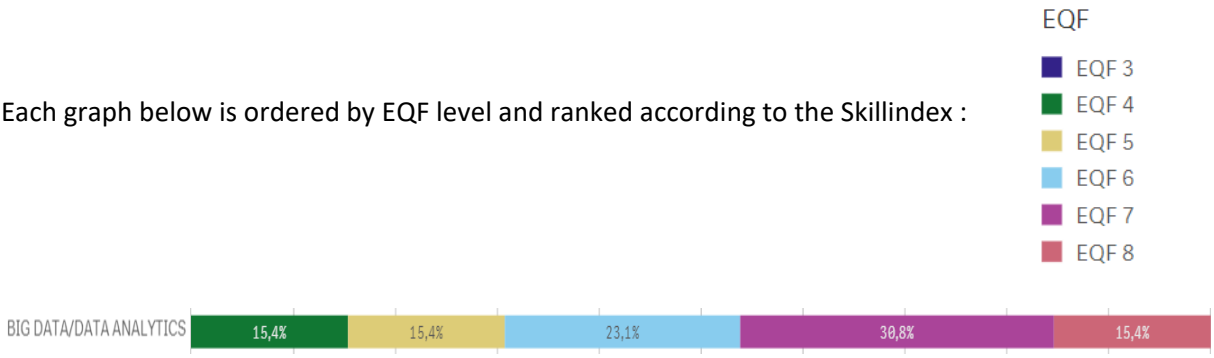


Figure 98: KPI 3.1 Skill Index (demand) – Overall sample

Figure 98 outlines the TOP20 Overall Skills ranked according to the Skillindex, which reflects the occurrence of each skill and the relationship of that skill to Drivers of Change identified in the Demand survey, as set out in the in the D2.7 Forecasting dissemination Report. Results of analysis for individual skills in relation to the number of relevant graduates and EQF level are presented below.

Each graph below is ordered by EQF level and ranked according to the Skillindex :



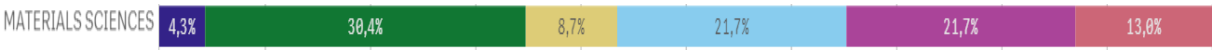
1. BIG DATA/DATA ANALYTICS is ranked first on the Skillindex with a significant gap to the second highest score. Based on the categorisation adopted this skill is closely related to DIGITALISATION. The average number of graduates within the EU is 794 per year and based on responses from the VET OFFER survey, provision is most likely to be at EQF 7 (30.8%) and EQF 6 (23.1%). Level EQF 3 is not relevant in this case.

2. SOFTWARE DEVELOPMENT is ranked second according to the Skillindex and can be termed a TECHNICAL skill with on AVG, 1764 graduates. Provision covers all EQF levels, most commonly at EQF 6 and 7 (both 22.7%), followed by EQF 8 with 18.2%

3. TECHNICAL KNOWLEDGE (another TECHNICAL skill) is in third place with a relatively high AVG number of graduates, at 27.376 per year. Provision is available at all EQF levels, but with a focus on lower levels, particularly at EQF4 (35.4%) and EQF3 and 5 (both 16.7%)

4. MECHATRONICS with an AVG of 3.336 graduates is another TECHNICAL skill provided mainly at EQF levels 4 (44,1%), 5(20,6%) and 6 (14,7%)

5. SYSTEM INTEGRATION is ranked fifth and is a sub-category of ELECTRIFICATION (VEHICLE SYSTEM profiles). The AVG number of graduates is 1290 per year, with provsion mainly at the EQF levels 4 (50%), 6 (18,2%) and 5(13,6%)



6. MATERIALS SCIENCE is a further TECHNICAL skill with a relatively high AVG number of graduates (12.189 per year). Provision is concentrated at EQF level 4 (30,3%), but with a significant proportion of provsion also at the higher levels of EQF 6,7 (both 21,7%) and 8 (13%).

7. LEARNABILITY is the highest ranked SOFT SKILL in the TOP20, with an AVG number of graduates of 13.967 per year. Provsion is focussed in particular at levels EQF 4 (37.5%) and EQF 3 (25%)

8. SPECIFIC MANUFACTURING PROCESSES with an AVG number of 1.017 graduates per year is the highest ranked Production / Manufacturing skill (Life cycle / product - process chain sub-

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category) in the TOP 20. Provision is focussed particularly at EQF levels 4 (43,8%) and 5 (25%). EQF Level 3 is not relevant.

9. DIGITAL SKILLS relate to DIGITALISATION with an AVG of 8.464 graduatesper year. Provision is predominantly at at EQF levels 4 (46,2%), 5(19,2%) and 6 (15,4%). EQF Level 8 is not relevant

10. ARTIFICAL INTELLIGENCE also relates to DIGITALISATION, with a somewhat lower AVG number of graduates (1.196 per year) than is the case in DIGITAL SKILLS. AI is provided at all levels with a slightly higher share at EQF levels 7 and 8.

11. ELECTRICAL/ELECTRONIC is another TECHNICAL skill, with an AVG of 7.402 graduates, with provision focussed in particular at EQF levels 4 (45,1%) and 5 (17,6%).

12. ADAPTABILITY/FLEXIBILITY is a second SOFT SKILL, with an AVG of 9.138 graduates per year, predominantly at EQF levels 3 (32%), 4 and 5.

13. R&D&I provision, relating to the Life cycle / product - process chain is relatively uncommon, with an AVG of 247 graduates per year. No EQF levels 3 and 4 is recorded, with most provision focussed at EQF levels 6 and 7.

14. AUTOMATION/ROBOTICS, which is an example of the sub-category PRODUCTION/MANUFACTURING (Life cycle / product - process chain) has an AVG of 2.464 graduates per year and is charaterised by a high proportion of provsion at EQF level 4.

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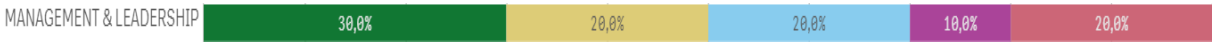
15. CYBERSECURITY, which relates to DIGITALISATION has a relatively small AVG number of graduates (619 per year) with provsion spread fairly evenly across different EQF levels.

16. MARKET ANALYSIS is another skill relating to the wider Life cycle / product - process chain profile, with a small AVG number of graduates (147 per year). With the exception of EQF level 5 (none recorded) and EQF level 4 where most provsion is recorded, the remainder is spread evenly across other EQF levels.



17. MANAGEMENT & LEADERSHIP which is an example of the wider SOFT SKILL profile, has an AVG of 1.571 graduates. With the exception of an absence of EQF level 3 provision it is fairly evenly sprad accross other EQF levels.

18. PROCESS ENGINEERING relates to the wider Life cycle / product - process chain profile with a relatively high AVG number of graduates (11.093 per year). Provision is concentrated in particular at EQF levels 4 (probably influenced by a larger number of respondents for this level) and 7 and 8.

19. AUTOMATED DRIVING represents an evolving VEHICLE SYSTEM profile with a small AVG number of graduates (745 per year). No provision at EQF levels 3 and 5 is recorded.

20. BATTERIES is another sub-category of ELECTRIFICATION (VEHICLE SYSTEM profiles) ranked within the TOP20 of the Skillsindex, with an AVG of 992 graduates spread across all EQF levels. The high concentration of EQF level 4 provsion is probably influenced by a larger number of VET school organisation respondents.

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6.3.1 DIFFERENCE BETWEEN DEMAND AND OFFER

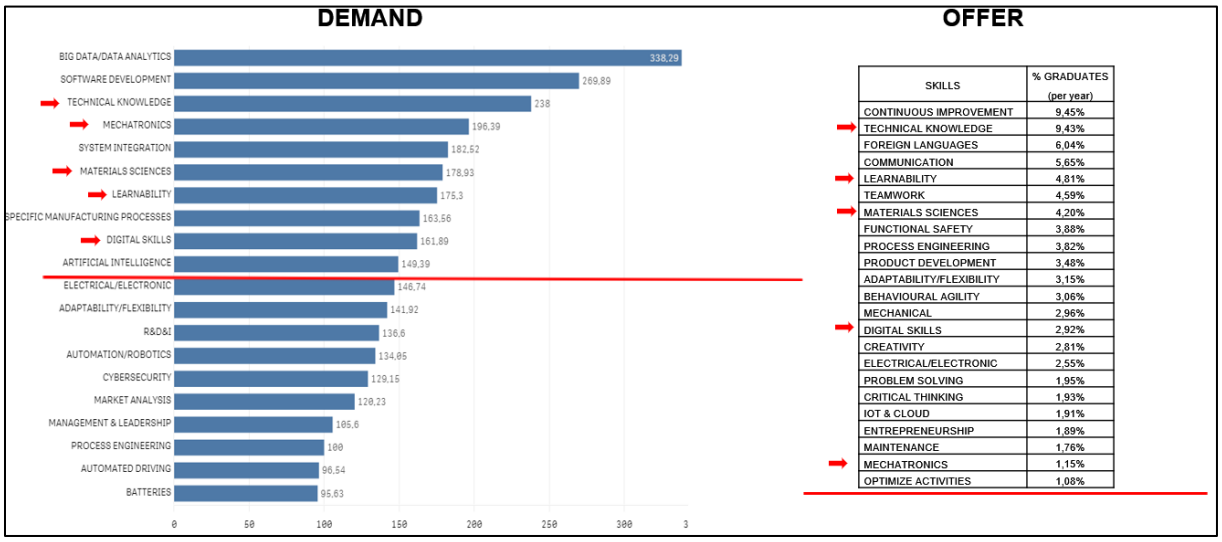

Figure 99: Skills comparison between the 2 surveys

Comparing TOP 10 Demand (of skills) with the Offer as per **Figure 99**, it is now necessary to increase the range from TOP 10 to TOP 20 into the Offer list to find at least 5 similarity.

"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 not aligned. More than before, now the difference between Demand and Offer is evident and it is important to better evaluate this situation (The "SOFT SKILLS" missing into the Demand list is due to a "take for granted" issue or there is a low interest in these skills?)

6.4 TRAINING PROVISION MECHANISMS APPROACH

Vocational Education and Training (VET) aims to equip people with knowledge, know-how, skills and/or competences required in particular occupations, or more broadly within the labour market.

The 3 most relevant types of VET in the context of the DRIVES project are:

- CVET[36]: Continuing vocational education and training is defined as "education or training after initial education or entry into working life, aimed at helping individuals to improve or update their knowledge and/or skills; acquire new skills for a career move or retraining; and/or continue their personal or professional development"

[36] http://www.cedefop.europa.eu/files/3070_en.pdf

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- IVET[37]: General or vocational education and training carried out in the initial education system, usually before entering working life. Some training undertaken after entry into working life may be considered as initial training (e.g. retraining); initial education and training can be carried out at any level in general or vocational education (full-time school-based or alternance training) pathways or apprenticeships.

- TVET[38]: Technical and Vocational Education and Training (TVET) is concerned with the acquisition of knowledge and skills for the world of work. Over time, various terms have been used to describe aspects now considered as comprising TVET. These include: Apprenticeship Training, Vocational Education, Technical Education, Technical-Vocational Education (TVE), Occupational Education (OE), Vocational Education and Training (VET), Professional and Vocational Education (PVE), Career and Technical Education (CTE), Workforce Education (WE), Workplace Education (WE), etc. Several of these terms are commonly used in specific geographic areas.

This section provides information about VET approaches and explores different ways of approaching training and learning. It is considered an important factor when defining the overall skills strategy and understanding the preferences of stakeholders in relation to VET provision and also supports the design and orientation of all the project work packages;
The "Demand" survey was in <<open format>> with most questions not guided by a multiple choice menu; the analysis has been undertaken only in relation to the main (normalised) responses. In the "Offer" survey a multiple choice option was available with all the normalised replies originating from the "Demand" survey-. The complete list of possible replies were:

- **Augmented reality / Virtual reality**: A three-dimensional virtual simulated environment mimics and enhances reality by providing digital information, allowing learners to practice skills and understand the implications of their actions.
- **Blended learning**: This is a mix of online and classroom-based learning
- **Classroom based training**: the classic school method, where skills are learned in a theoretical environment, with a preference for academic and analytical approaches.

[37] https://www.eqavet.eu/eu-quality-assurance/glossary/initial-educuation-and-training-(ivet)
[38] https://unevoc.unesco.org/go.php?q=What+is+TVET

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- **Closest relation with university/VET providers**: provides the potential to create a planned and continuous close cooperation between companies and service providers, offering counselling, support and training.
- **Dual system**: includes both school training and work experience with an emphasis on apprenticeships.
- **Gamifications**: This describes the application of typical elements of game playing (e.g. point scoring, competition with others, rules of play, etc.) to other areas of activity. It is often used e.g. as an online marketing technique to encourage engagement with a product or service.
- **Intense learning**: This is the concentration of learning into a short period of time, e.g. workshops are intended to be an intensive learning experience for intermediate to advanced topics.
- **Mentoring:** Similar to the previous on the job training but now the "training by doing" activity is supported by a mentor (an identified skilled person) who follows and supports individuals who need or want the same skills and advantages to move up in work, skill level, or school performance.
- **Networking and exchange information of employees/experts/employers**: This describes the action or the process of interacting with others to exchange information and develop professional or social contacts.
- **On the job training**: employees learn in the environment where they will need to practice the knowledge and skills obtained during training.
- **Online courses**: This is a mix between a 'theoretical' vocational training (without the physical presence of the employee = online) and the possibility to have more interaction with user forums to support community interactions among students, professors, and teaching assistants as well as immediate feedback to tests and assignments
- **Work based training**: It is an educational strategy to provide students with real-life work experiences where they can apply academic and technical skills and improve employability. It is usually a series of educational courses which integrate the school or university curriculum with the workplace in order to create a different learning paradigm. Work-based learning encompasses a diversity of formal, non-formal and informal arrangements including apprenticeships, work placement and informal learning on the job
- **University**: high-level educational studies to obtain degrees (and above) and where academic research is performed

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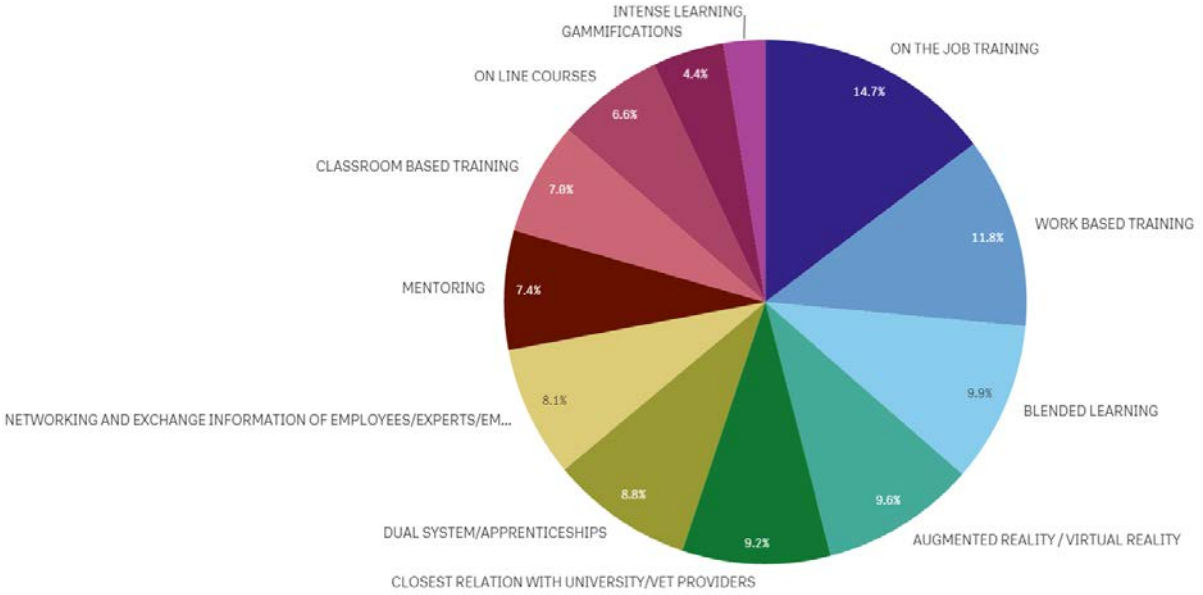

Figure 100: KPI 5.1 (Offer) VET Approaches – Overall sample

Figure 100 summarises all responses relating to the effectiveness of current VET approaches. “On the job” and “work based” training is cited most frequently accounting for roughly 25% of all 13 different identified approaches. Excluding these two approaches there is a broadly even distribution of other categories. “Intensive learning” and “Gamifications” are listed least with less than 5% each. It is noticeable that “online course” are cited relatively infrequently (6.6 %) given that the DRIVES project is focussing in particular on this type of training approach.

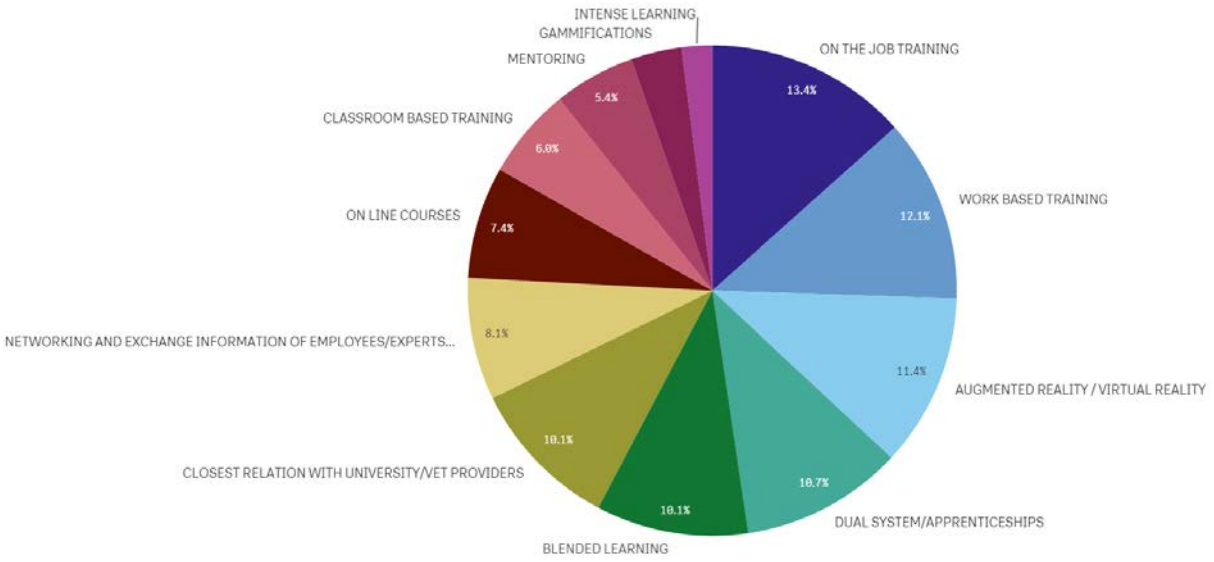

Figure 101: KPI 5.1 (Offer) VET Approaches – VET sample

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Figure 101 outlines the same analysis but solely from the perspective of VET providers, schools and universities. Only slight differences are evident when compared with responses from all stakeholders. Again, "on the job" and "work based" training accounts for more than 25% of all approaches cited, whereas "Intensive learning" and "Gamifications" are cited the least, at less than 5 % each. Of particular note is that "augmented reality/ virtual reality" is ranked 3rd in terms of frequency (more than 10%) even though this is a relatively new concept.

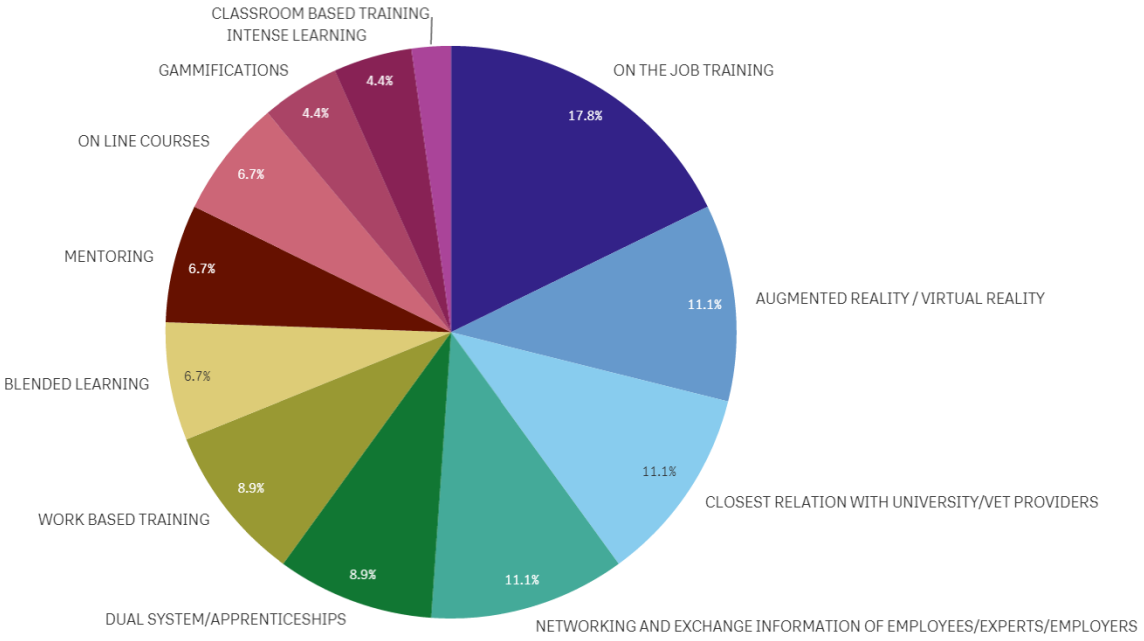

Figure 102 KPI 5.1 (Offer) VET Approaches – INSTITUTE sample

Figure 102 outlines responses from institutes in relation to the effectiveness of current VET approaches. As before, "on the job training" is ranked highest (> 17 %). As was the case with VET providers, "augmented reality/ virtual reality" is also cited quite frequently (11.1 %), as is "closest relation with university/VET providers" (11.1%).

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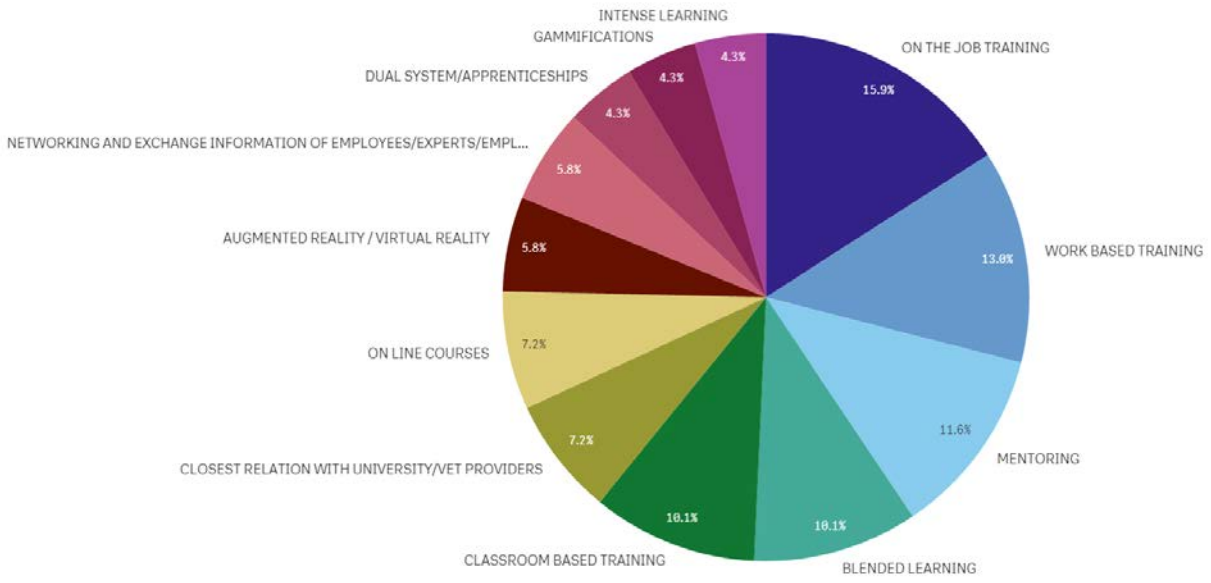

Figure 103 KPI 5.1 (Offer) VET Approaches – PRIVATE COMPANY sample

Results from the perspective of private companies involved in provision of VET is outlined in **Figure 103**. Again, "on the job" and "work based" training accounts for more than 25% of all approaches cited. Of particular note is that for private companies "mentoring" is cited quite frequently, accounting for 11 % of responses.

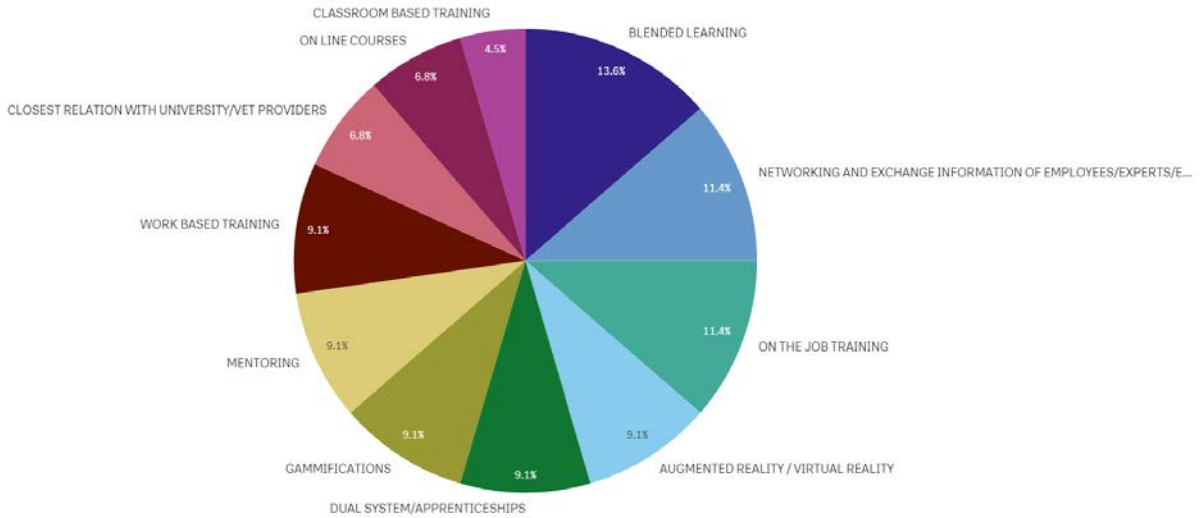

Figure 104 KPI 5.1 (Offer) VET Approaches – UMBRELLA ORG. sample

Figure 104 outlines the same analysis but from the perspective of umbrella organisations. It is striking that perceptions of the effectiveness of approaches to provision differ significantly from all other stakeholders. "Blended learning" (13.6 %) and "networking" (11.4 %) are most commonly cited

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effective, accounting for 25% of all responses while "worked based training" (9.1 %) was cited relatively infrequently.

6.4.1 DIFFERENCE BETWEEN DEMAND AND OFFER

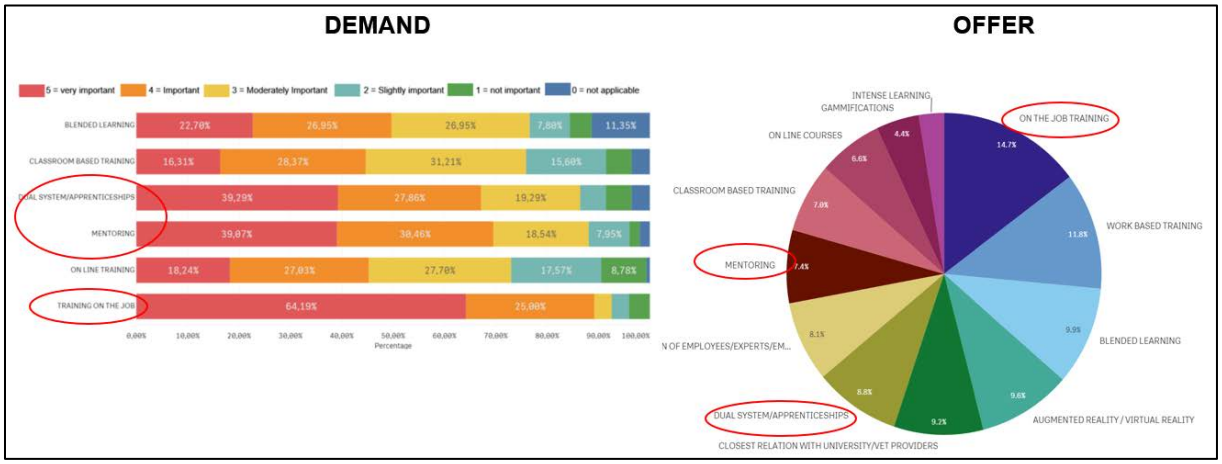

Figure 105: stakeholders preferences in relation to the most appropriate VET mechanisms to meet changing needs

As per **Figure 105**, the Demand and Offer both highlight the importance of "TRAINING ON THE JOB" as the most effective VET approach. Even if in both vision "MENTORING" and "DUAL SYSTEM/APPRENTICESHIPS" are present, there is a big difference and the high importance from the Demand side is opposed to a low rated in the Offer side.

6.5 RECOGNITION AND QUALIFICATION FRAMEWORKS

The necessity for "standard(s)" across the EU Automotive sector to enable movement of skilled workers between EU countries and recognition of skill levels relating to training undertaken to support increased mobility of workers is a key focus of the DRIVES project. A pre-determined list of the most recognised standard and qualification frameworks was included in the questionnaire, with the option for stakeholders to add to this list. The pre-determined list comprised five possible choices coming from the previous "Demand" survey, plus the possibility to add others; the activity has been undertaken with reference to 5 key qualification frameworks listed in the questionnaire (the "other" possibility has been normalised with "NATIONAL" recognition where available):

- BUREAU VERITAS[39]
- ECQA[40]

[39] https://group.bureauveritas.com/
[40] https://www.ecqa.org/

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- EQF[41]
- IATF[42]
- NATIONAL: specific standards used into an EU nation and not recognised abroad
- TUV SUD[43]
- VDA-QMC[44]

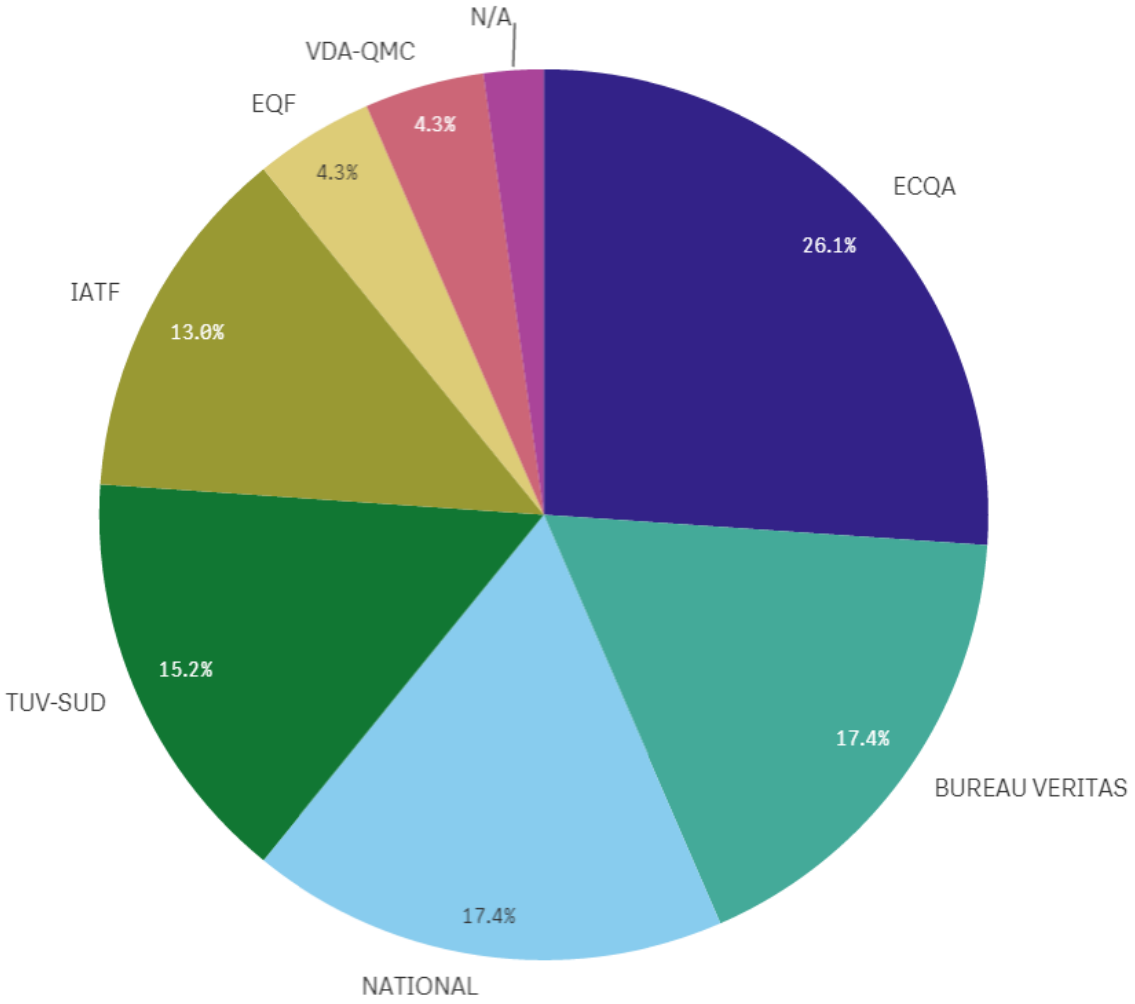

Figure 106: KPI 6.1 (Offer) Skill Recognition Standards – Overall sample

Figure 106 summarises overall results in relation to the importance of different Skill Recognition Standards to those organisations respnding to the offer survey. “ECQA” accounts for more than 25 % of all recognised standard and qualification frameworks cited, followed by “BUREAU VERITAS” (17.4 %), and “NATIONALS” (17.4%); It should be noted that although “ECQA”, “BUREAU VERITAS”, “TUV-

[41] https://www.cedefop.europa.eu/en/events-and-projects/projects/european-qualifications-framework-eqf
[42] https://www.iatfglobaloversight.org/
[43] https://www.tuvsud.com/en
[44] https://vda-qmc.de/en/

SUD" and "IATF" account for more than 70% of all skill recognition standards cited, "NATIONAL" standards are still considered important.

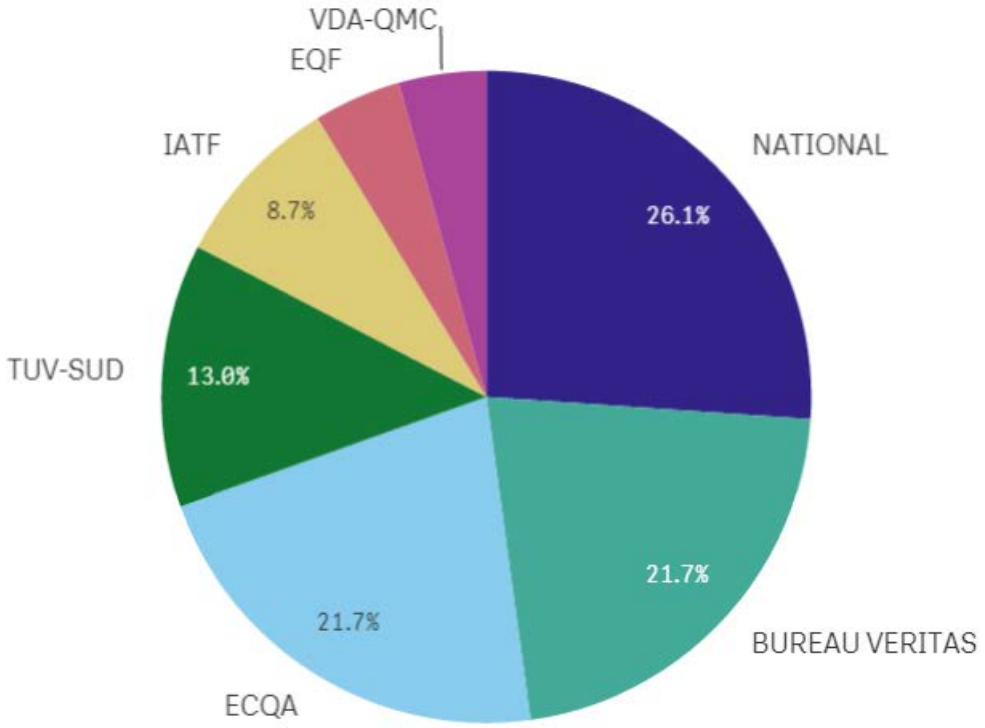

Figure 107: KPI 6.1 (Offer) Skill Recognition Standards – VET sample

Perceptions of the importance of different skill recognition standards from the perspective of VET providers is set out in **Figure 107**. It is important to note that for these stakeholders the relevant "NATIONAL" standard is ranked first (26.1%) in terms of importance, followed by "BUREAU VERITAS" (21.7%) and "ECQA" (21.7%). This underlines the utilisation of national standards within the EU VET system.

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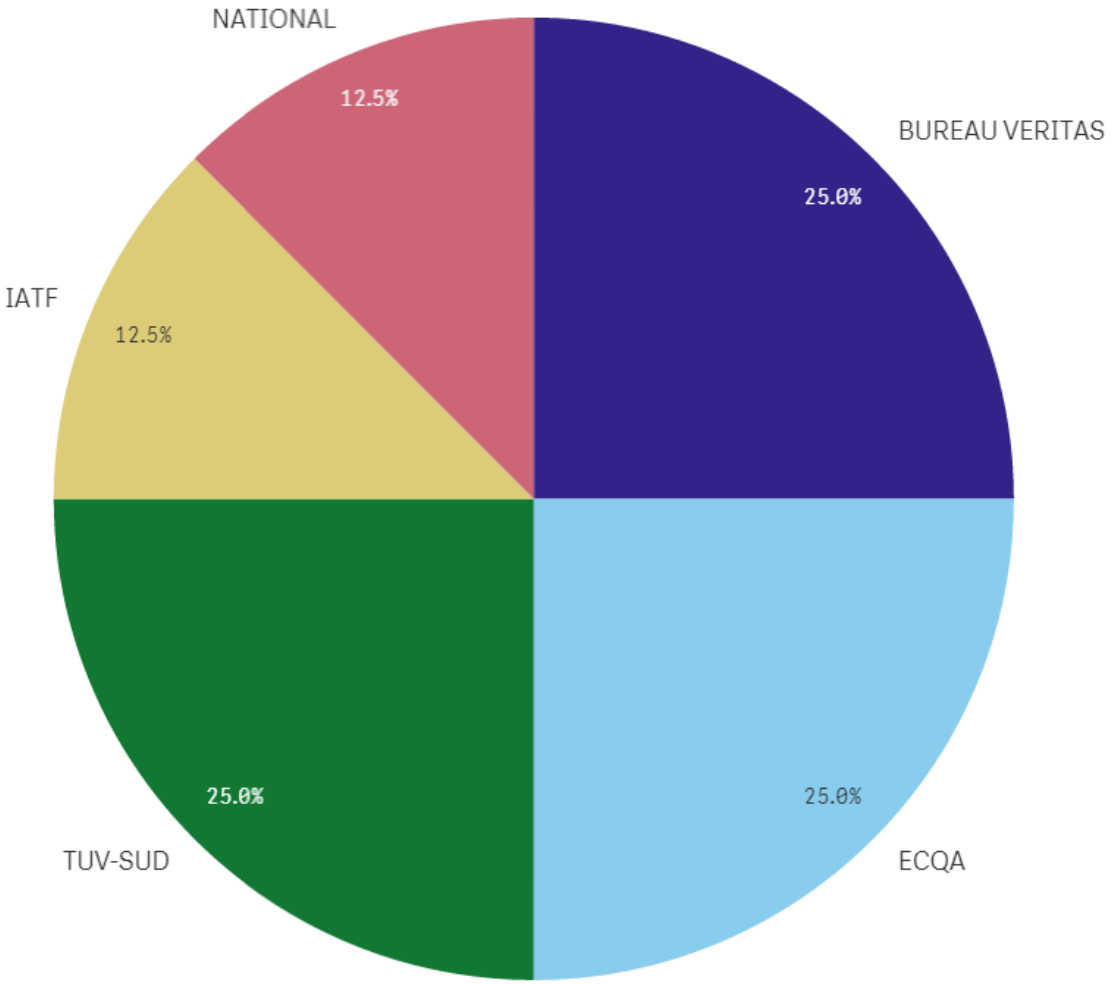

Figure 108: KPI 6.1 (Offer) Skill Recognition Standards – INSTITUTE sample

Figure 108 sets out the perceptions of the importance of different skill recognition standards from the perspective of Institutes. "ECQA", "BUREAU VERITAS" and "TUV-SUD" each account for a quarter (25%) of all skill recognition standards cited with "IATF" and "NATIONAL" skill recognition standards (each 12.5 %) accounting for the remainder. However, it should be noted that the total number of responses from Institutes is relatively low and therefore not statistically significant. However, "NATIONAL" standards appear less important for this group of stakeholders with "BUREAU VERITAS", "ECQA" and "TUV-SUD" the most used and recognised.

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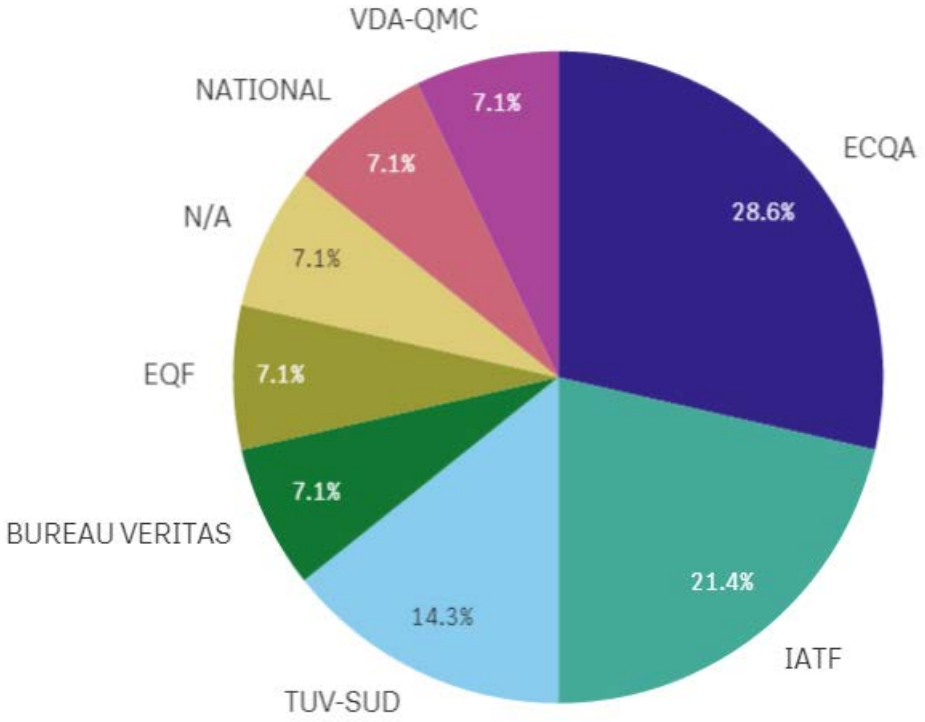

Figure 109: KPI 6.1 (Offer) Skill Recognition Standards – PRIVATE COMPANY sample

Perceptions of the importance of skill recognition standards from the perspective of private companies is set out in **Figure 109**. For this group of stakeholders "ECQA" is the most recognised skill standard accounting for 28.6 % of responses, followed by "IATF" (21.4 %) and "TUV-SUD" (14.3 %). Of note is that "BUREAU VERITAS" is somewhat less important by comparison with the position for all stakeholders, accounting for only 7.1 % of responses.

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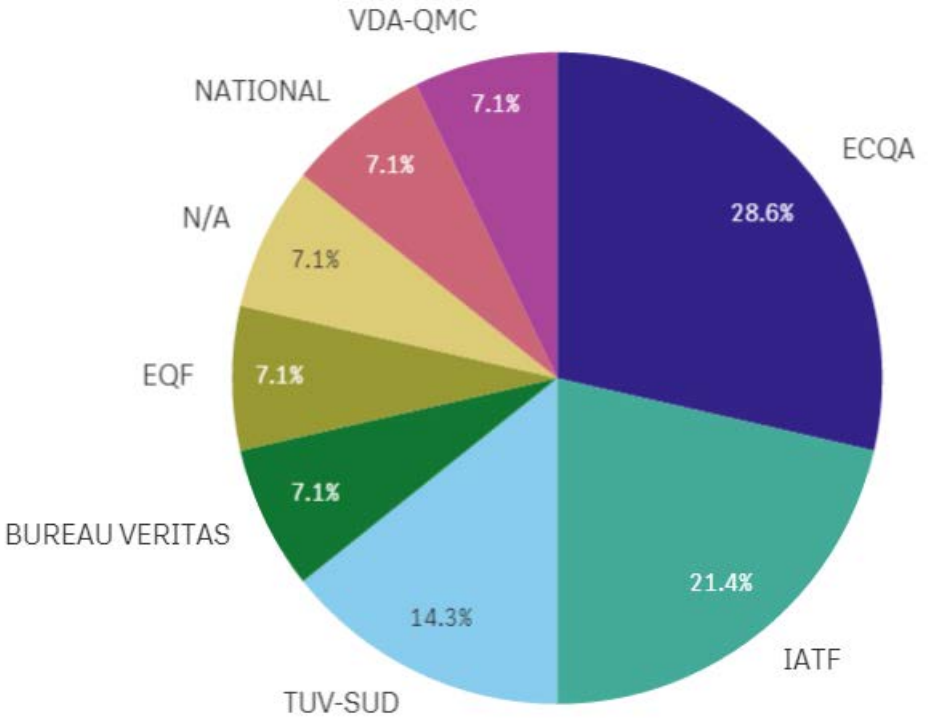

Figure 110: KPI 6.1 (Offer) Skill Recognition Standards – UMBRELLA ORG. sample

Figure 110 sets out perceptions of the importance of skill recognition standards from the perspective of "Umbrella Organisations." For this group "ECQA" is by far the most frequently recognised skill standard at 28,5 %, followed by "IATF" (21,4%). This is followed by "TUV-SUD" and "BUREAU VERITAS" at 14,3% and 7,1% respectively.

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6.5.1 DIFFERENCE BETWEEN DEMAND AND OFFER

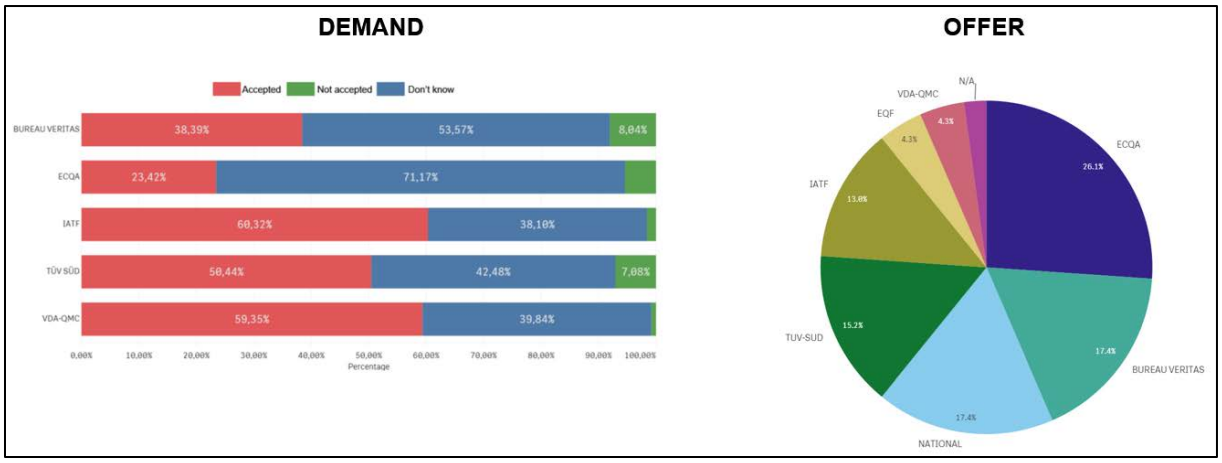

Figure 111: most important skills recognition and qualification standards accepted

In **Figure 111** clear differences are evident in relation to the results of the Demand and Offer surveys. These differences are most striking in relation to the following: "ECQA" is most frequently recognised by providers (respondents to the Offer survey) but the least recognised by respondents to the Demand survey. On the other hand, "VDA-QMC" is widely accepted (and "IATF") by Demand survey respondents but recognition is negligible in relation to the Offer survey respondents. Also, of particular note is the importance attached to "NATIONAL" standards by VET stakeholders, ranked 3rd: to better investigate if "national" means <<only valid / recognised in a specific country>> .

6.6 RECRUITMENT FOR THE AUTOMOTIVE SECTOR METHODS

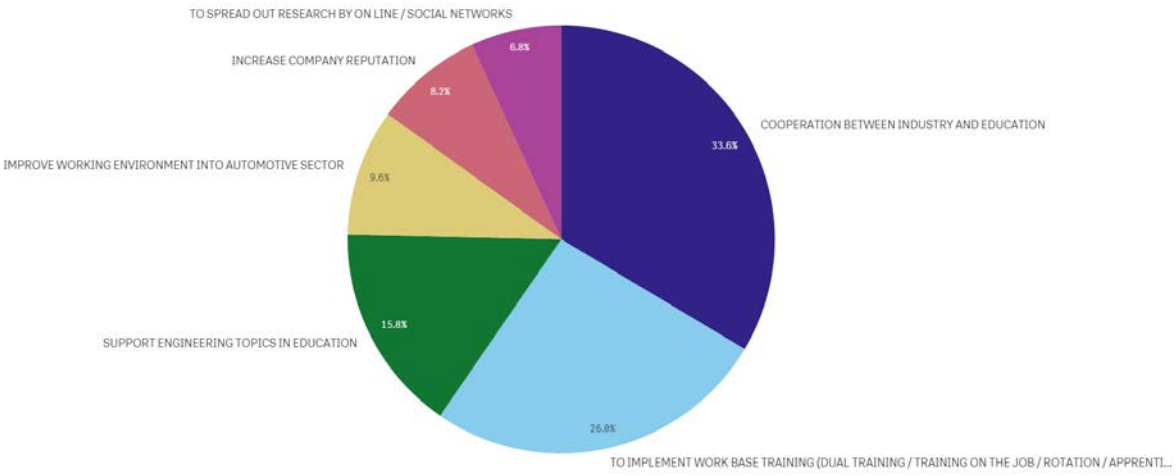

Figure 112: KPI 7.3 (Offer) RECRUITMENT AND ATTRACTIVENESS: METHODS – Overall sample

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Figure 112 focuses on overall key performance indicators related to "RECRUITMENT AND ATTRACTIVENESS METHODS" in relation to the automotive industry, in particular, perceptions of the most effective recruitment methods to recruit workers required. Cooperation between the automotive industry and the relevant education stakeholders for this domain is considered of primary importance, the most frequently cited response at 33.6%. This is followed by implementation of work base training (26.0%), underlining the importance of training on the job, dual training and other interventions. Further priorities identified include support for engineering topics in education, ranked third at 15.8%. By contrast, the improvement of the work environment only accounts for 9.6% of responses, with company image and reputation (8.2%) and research dissemination (6.8%), the least cited methods.

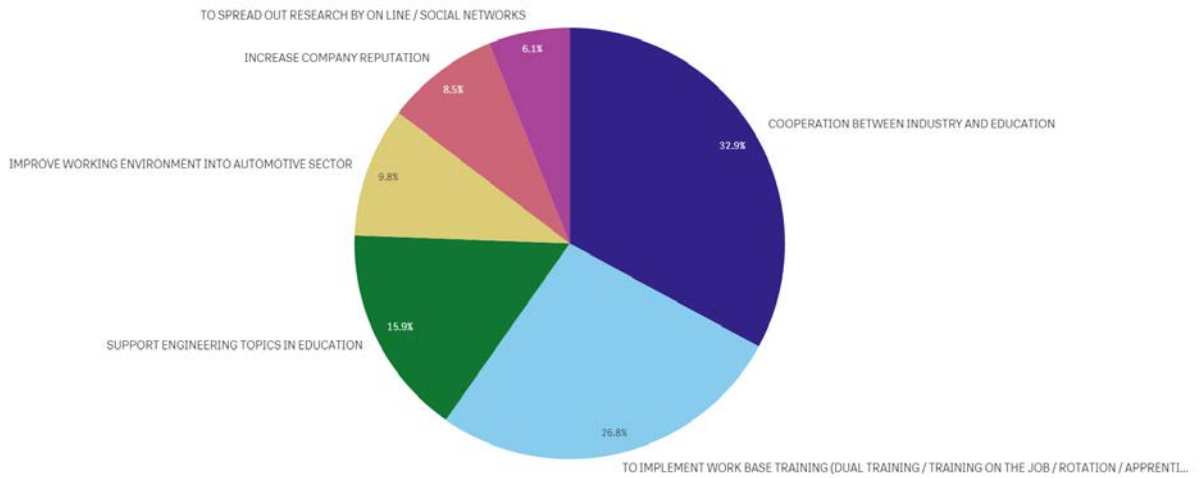

Figure 113: KPI 7.3 (Offer) RECRUITMENT AND ATTRACTIVENESS: METHODS – VET sample

Figure 113 outlines the responses of vocational education and training centres with regard to RECRUITMENT AND ATTRACTIVENESS METHODS. Once again, the most frequently cited method is cooperation between the automotive industry and education stakeholders (32.9%), with work based training ranked second, at 26.8%. A further method identified as important by VET centres is the support for engineering topics in education, ranked third at 15.9%. Only 9.8% of responses identified improving the work environment in the automotive sector. As is the case with all respondents, increasing company reputation and communication of research through social media are identified the least frequently, at 8.5% and 6.1% of responses respectively.

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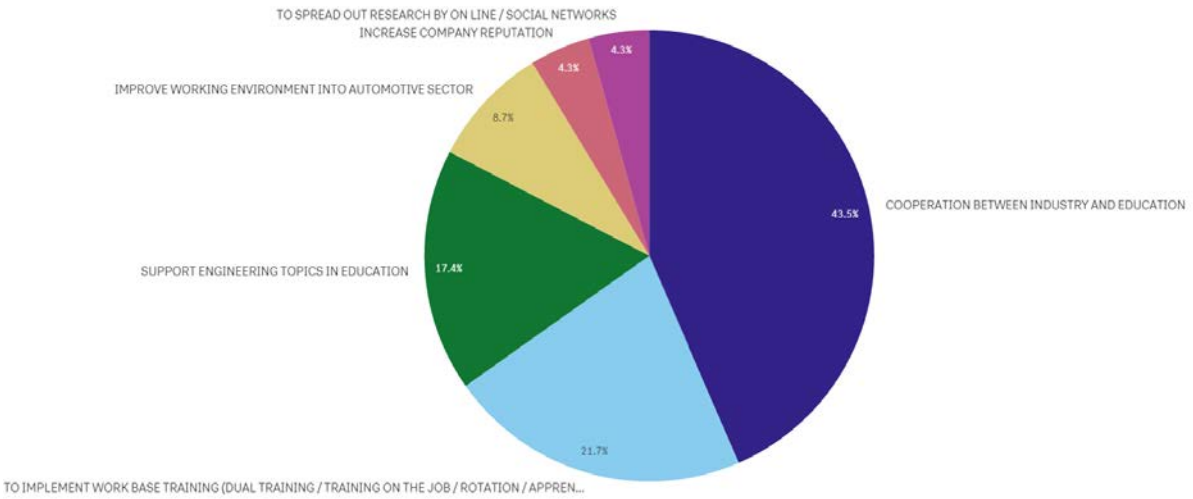

Figure 114: KPI 7.3 (Offer) RECRUITMENT AND ATTRACTIVENESS: METHODS – INSTITUTE sample

Figure 114 outlines the responses of Institutes with regard to RECRUITMENT AND ATTRACTIVENESS METHODS. The most frequently cited methods were cooperation between the automotive industry and education (43.5%). This is followed by implementation of work-based training, ranked second at 21.7%. Support for engineering topics in education is ranked third at 17.4%, a method identified as somewhat more important by Institutes than is the case with the VET centres. Improving the work environment in the automotive sector is considered somewhat less important (8.7%), together with social media dissemination and company reputation strategies, both at 4.3%.

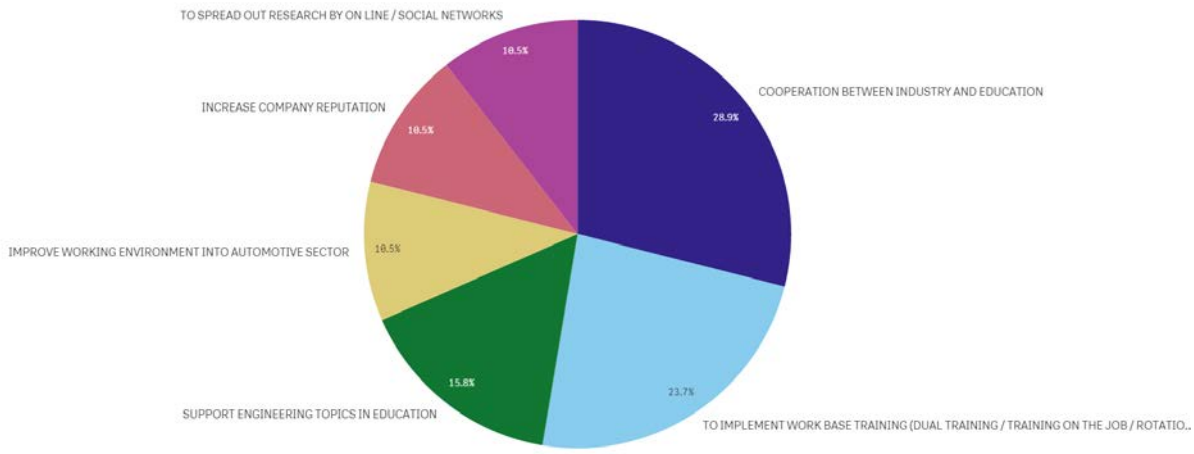

Figure 115: KPI 7.3 (Offer) RECRUITMENT AND ATTRACTIVENESS: METHODS – PRIVATE COMPANY sample

In relation to private companies (**Figure 115**), the most important recruitment methods are identified as cooperation between the automotive industry and education (28.9%) and implementation of work based training (23.7%). Supporting engineering topics in education is ranked third, at 15.8% of responses. By contrast with other stakeholders, private companies attach more importance to

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company reputation and the use of social media for material dissemination than is the case with VET centres and institutes (both at 10.5%), together with improvements to the work environment.

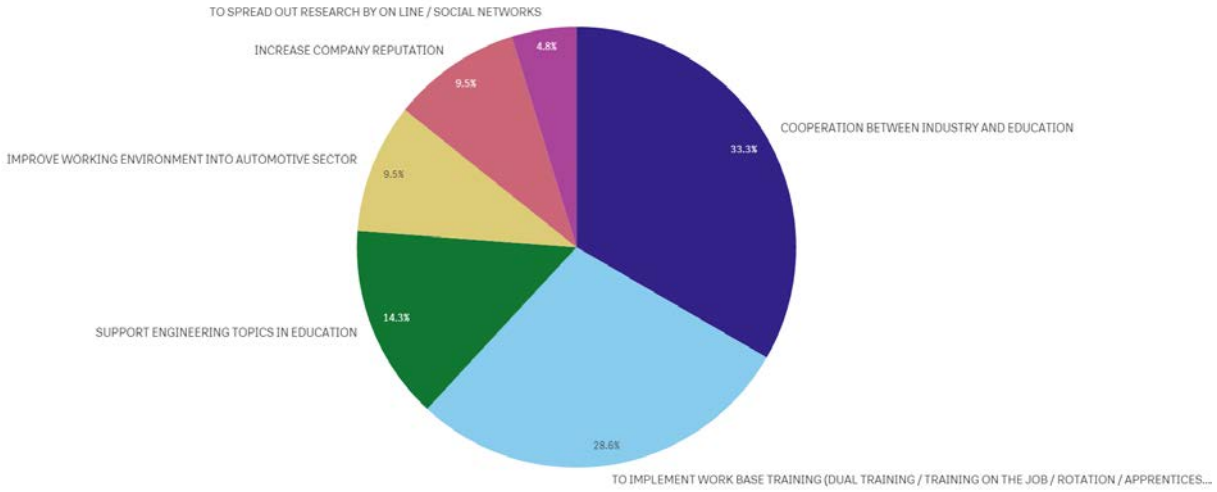

Figure 116: KPI 7.3 (Offer) RECRUITMENT AND ATTRACTIVENESS: METHODS – UMBRELLA ORG. sample

Figure 116 indicates that the perceptions of Umbrella organisations in relation to RECRUITMENT AND ATTRACTIVENESS METHODS are similar to VET centres, ranking – once again – the cooperation between industry and education at 33.3%, and work-based training at 28.6%. Support for engineering is ranked third at 14.3%. Increased company reputation is, (as is the cases with private companies), identified as equally important as improvements to the working environment in the automotive sector, both at 9.5%. Finally, online dissemination of research through social media, once again, remained the lowest priority for the umbrella organisations (4.8%).

6.6.1 DIFFERENCE BETWEEN DEMAND AND OFFER

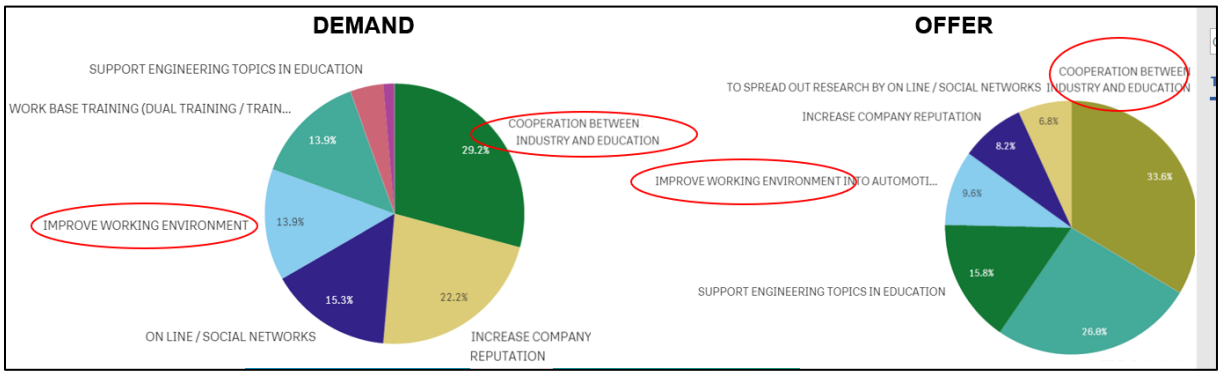

Figure 117: best recruiting method to attract new and talented (young) workforce

Respondents from both the Offer and Demand surveys identify in **Figure 117** "COOPERATION BETWEEN THE INDUSTRY AND EDUCATION" as the most important method, but other priorities differ significantly between these two different sets of stakeholders. The differences are most obvious with respect to a visible in "ONLINE/SOCIAL NETWORK", with respondents to the Offer survey consistently placing these methods as the least important, while respondents to the Demand survey place a somewhat higher level of importance on these methods (A combined total of 15.3%). Company Reputation ("INCREASE COMPANY REPUTATION" as a means of attracting workers into the sector) is also perceived as more important on the Demand side, ranked second at 22.2%, while respondents to the Offer survey placed it between 4.3% and 10.3%. While support for engineering topics is seen as very important from the perspective of respondents to the Offer survey, Demand side respondents – interestingly - rank this as the least important.

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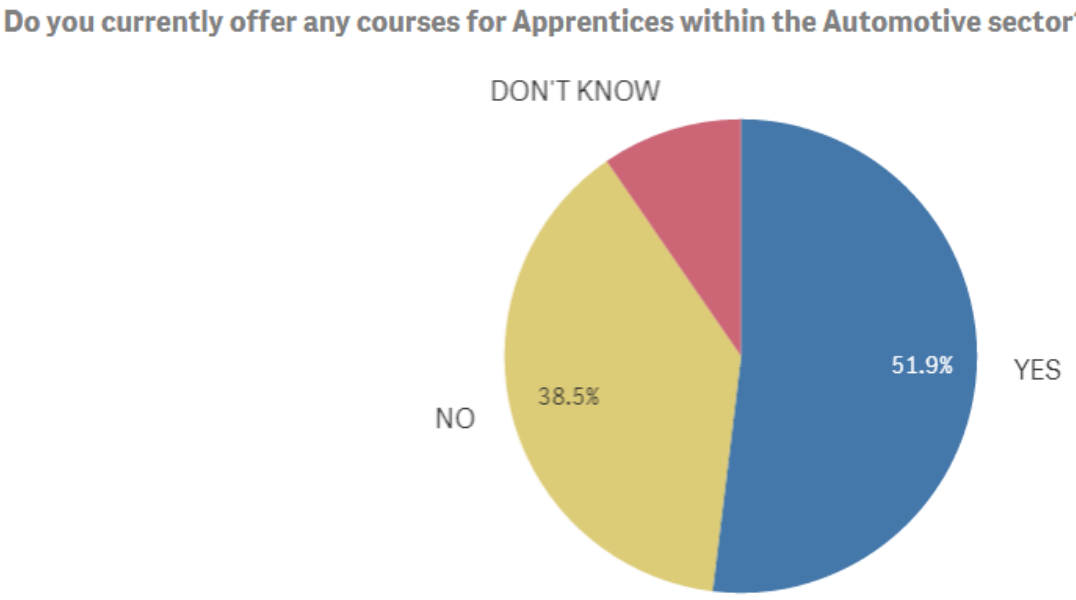
6.7 APPRENTICESHIP METHODS



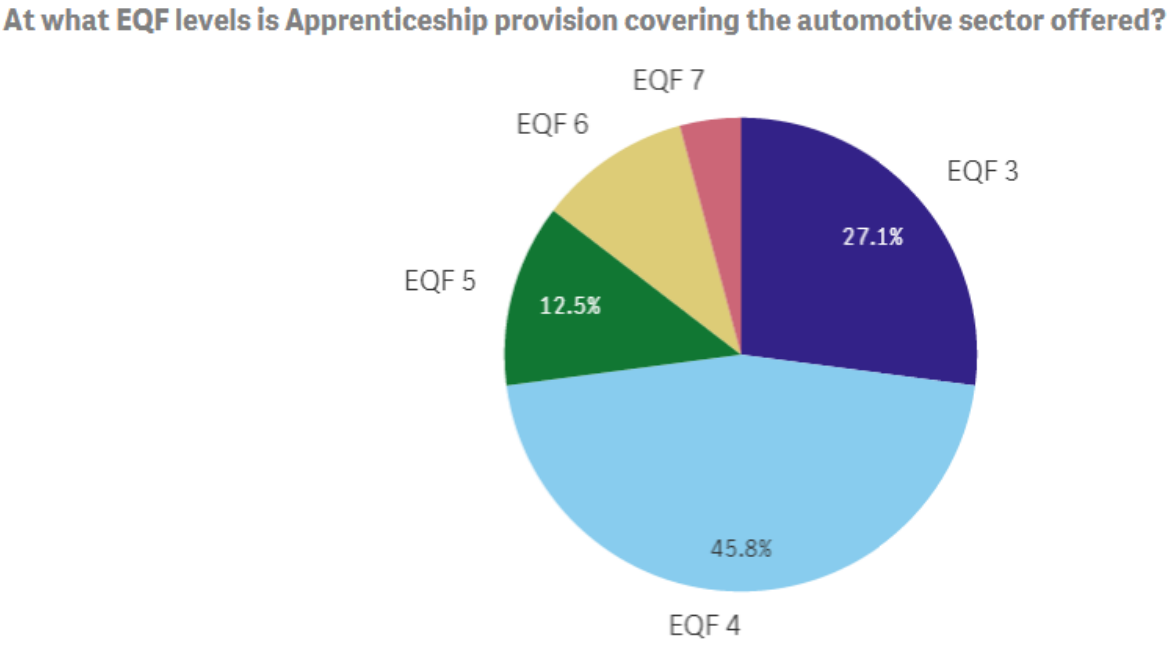


Figure 118: KPI 5.6 (Offer) APPRENTICESHIP AND EQF LEVEL– Overall sample

Just over half of all respondents to the survey indicated that they currently offer courses for Apprentices within the Automotive sector. Looking at the apprenticeship offer in more detail, almost half of these organisations offer this provision at EQF level 3 (Accounting for 27% of all responses to this question), more than 8 in 10 at level 4 (Accounting for 46% of all responses) 22% at level 5, 19% at level 6 and 7% at level 7. Provision at EQF level 5 or above accounts for 17% of all responses.

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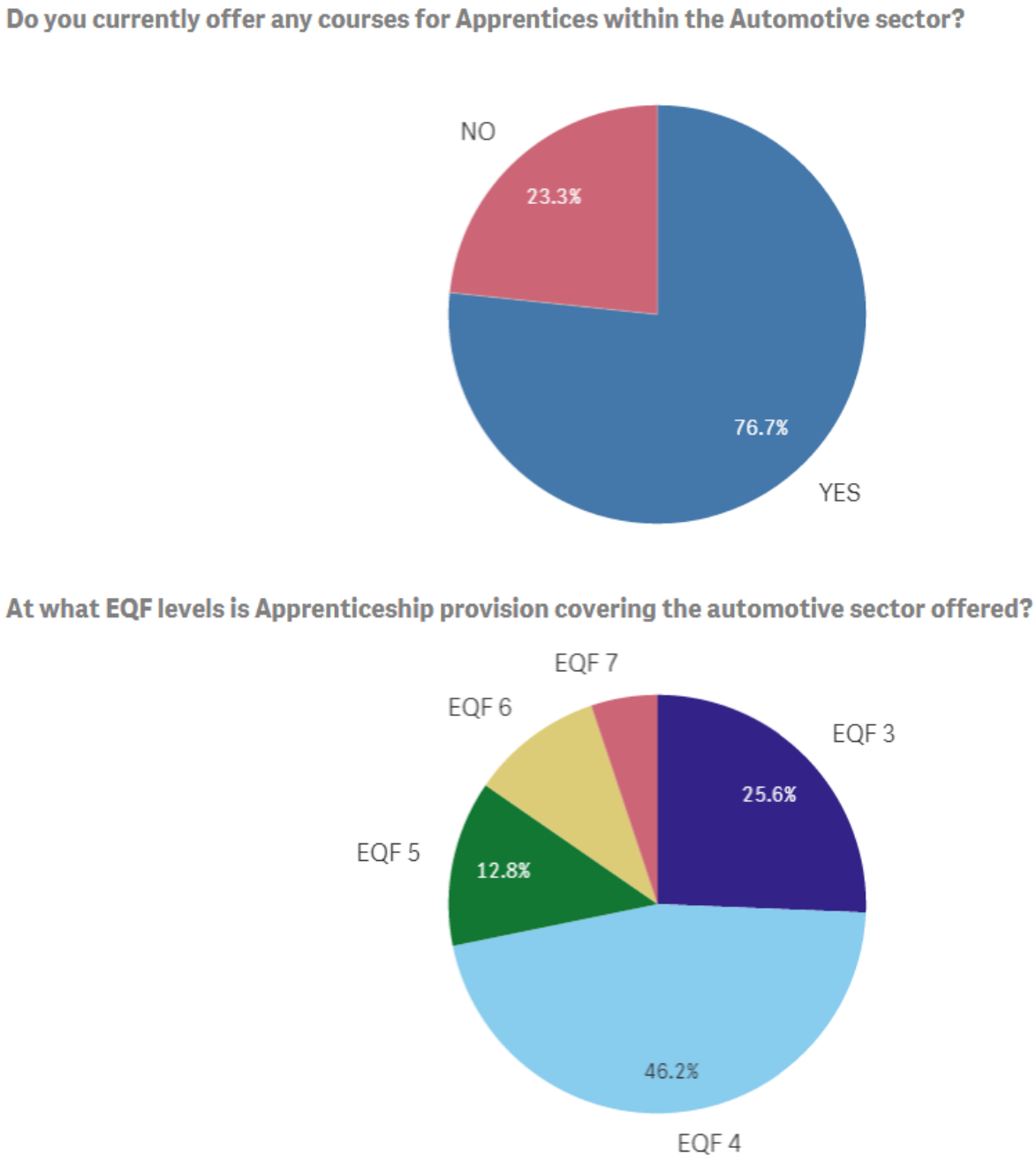

Figure 119: KPI 5.6 (Offer) APPRENTICESHIP AND EQF LEVEL – VET sample

Just over three quarters (77%) of all VET organisations responding to the survey indicated that they currently offer courses for Apprentices within the Automotive sector. EQF level 3 provision accounts for just over a quarter of all responses, almost half (46% of all responses) is accounted for by level 4 provision and 18% of all responses are accounted for by EQF level 5 or above provision.

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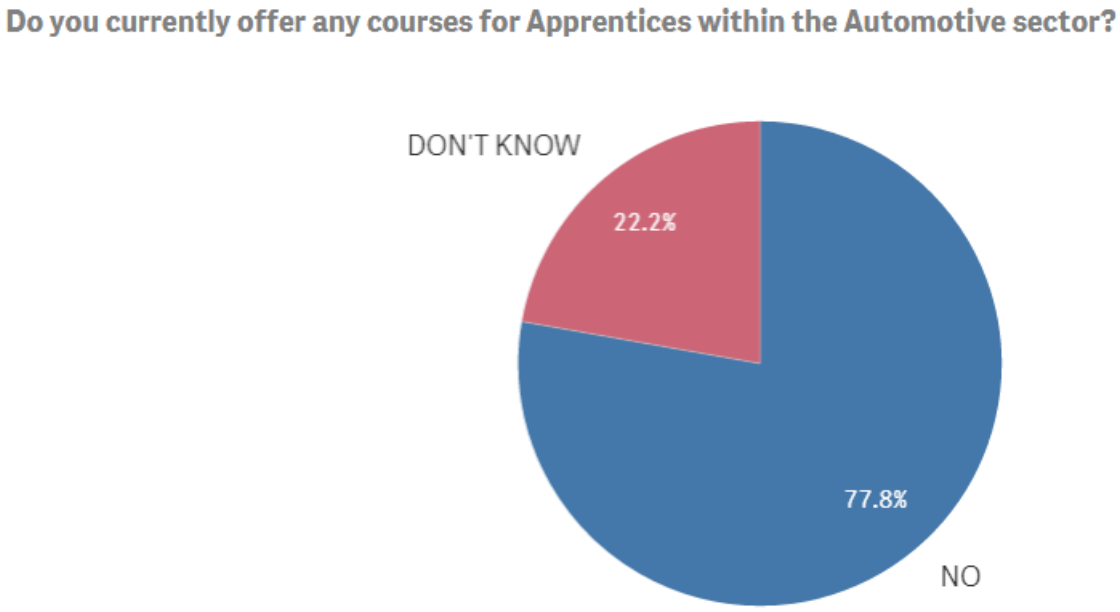

Figure 120: KPI 5.6 (Offer) APPRENTICESHIP AND EQF LEVEL – INSTITUTE sample

No Institutes responding to the survey indicated that they currently offer courses for Apprentices within the Automotive sector – (78% indicated this was the case and 22% didn't know).

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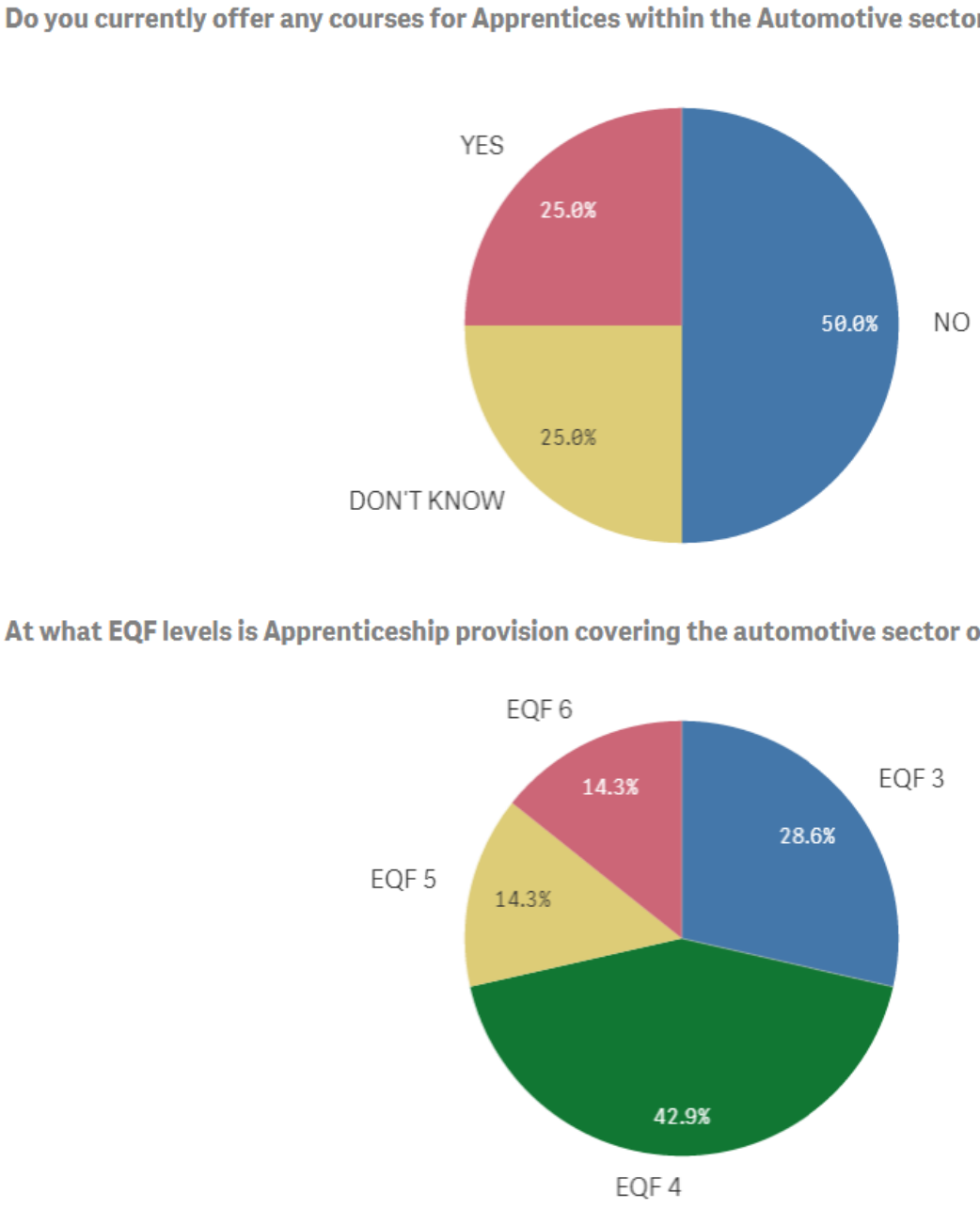

Figure 121: KPI 5.6 (Offer) APPRENTICESHIP AND EQF LEVEL – PRIVATE COMPANY sample

A quarter of private companies responding to the survey indicated that they currently offer courses for Apprentices within the Automotive sector, with half indicating this was not the case and the remaining quarter didn't know. 29% of all responses from private companies offering this provision related to EQF level 3 provision, 43% related to level 4 provision, and 28% related to EQF level 5 or 6.

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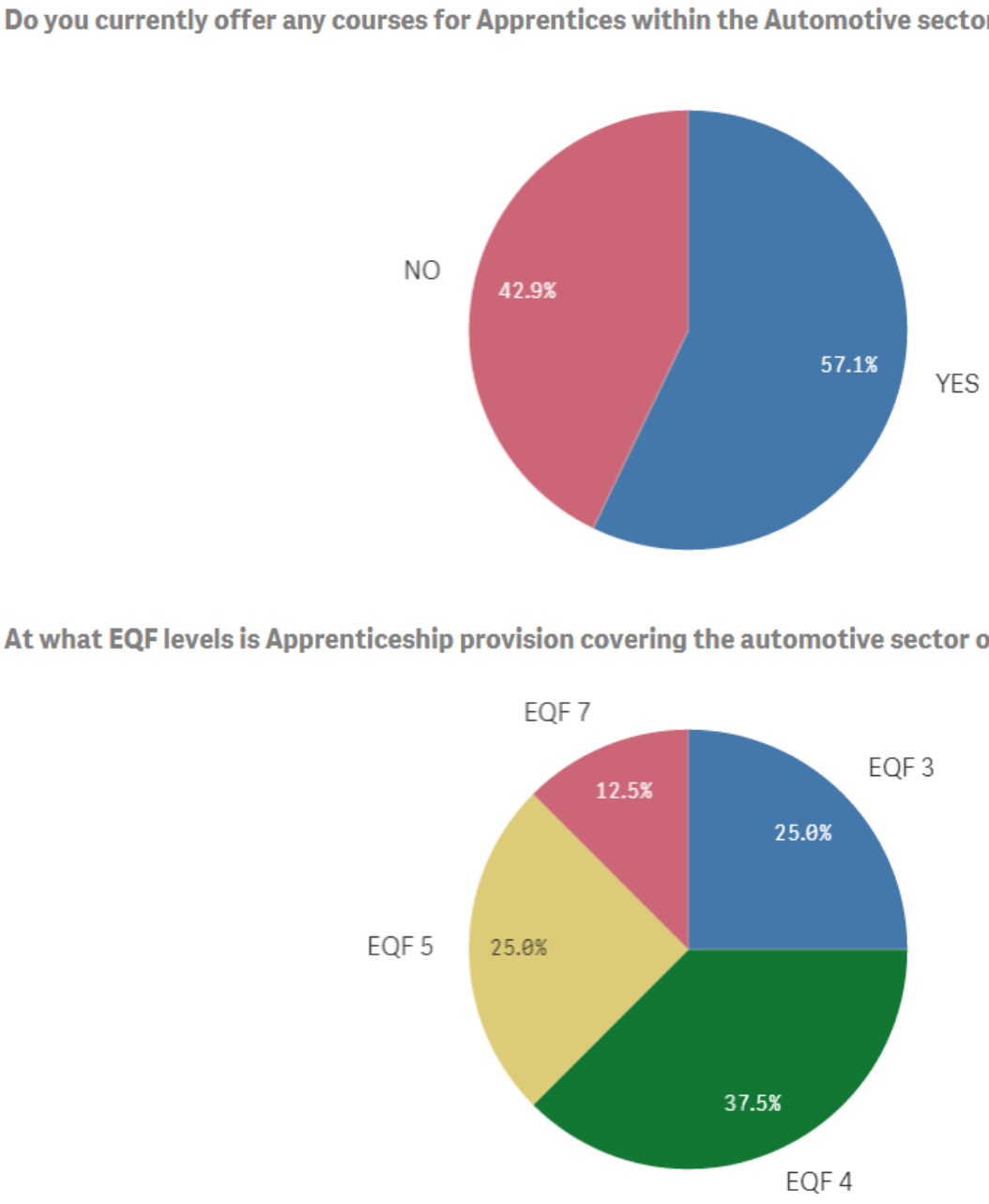

Figure 122: KPI 5.6 (Offer) APPRENTICESHIP AND EQF LEVEL– UMBRELLA ORG. sample

Nearly 6 in 10 (57%) of all Umbrella organisations responding to the survey indicated that they currently offer courses for Apprentices within the Automotive sector. A quarter of responses from these organisations offering this provision related to EQF level 3 provision, 38% related to level 4 provision, 25% to EQF level 5 and 13% to level 6.

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6.7.1 DIFFERENCE BETWEEN DEMAND AND OFFER

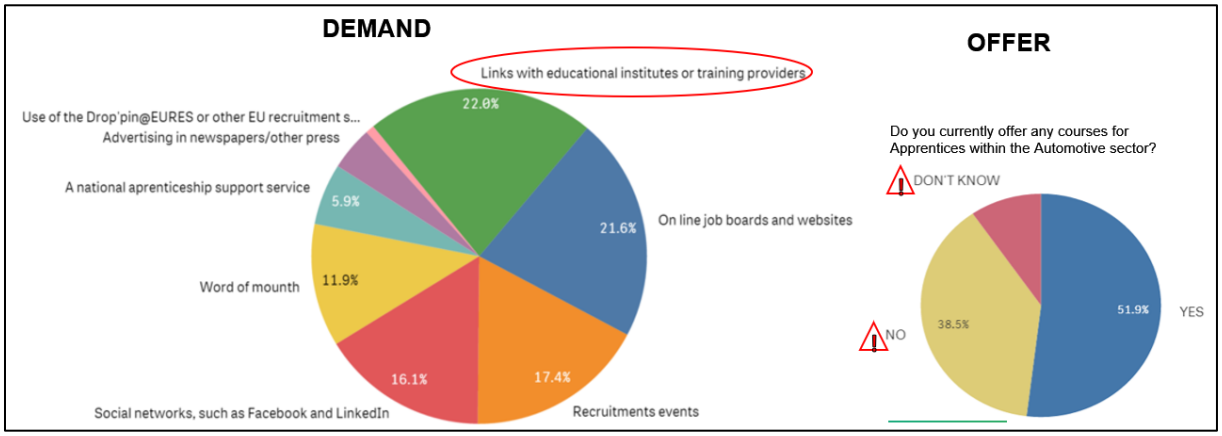

Figure 123: the main methods used to recruit apprentices

Even if it is not possible to assess the difference between overall Demand and the provision 'Offer' with respect to Apprenticeships directly from the survey, it is clear that a "LINK WITH EDUCATIONAL INSTITUTES OR TRAINING PROVIDERS" is essential from Demand point of view as the main methods used to recruit apprentices as per **Figure 123**; from Offer point of view, only 52% of interviewed offers courses for Apprentices. It also true that the increasingly globalised nature of the automotive sector contrasts with apprenticeships that tend to be focussed nationally, which poses particular challenges for employers when choosing whether to participate in the apprenticeship systems of those countries they operate in and for the mobility of apprentices seeking employment across national boundaries.

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APPENDIX

A RANKING OF TAUGHT SKILLS PER GRADUATES (PER YEAR)

SKILLS	% GRADUATES (per year)
CONTINUOUS IMPROVEMENT	9,45%
TECHNICAL KNOWLEDGE	9,43%
FOREIGN LANGUAGES	6,04%
COMMUNICATION	5,65%
LEARNABILITY	4,81%
TEAMWORK	4,59%
MATERIALS SCIENCES	4,20%
FUNCTIONAL SAFETY	3,88%
PROCESS ENGINEERING	3,82%
PRODUCT DEVELOPMENT	3,48%
ADAPTABILITY/FLEXIBILITY	3,15%
BEHAVIOURAL AGILITY	3,06%
MECHANICAL	2,96%
DIGITAL SKILLS	2,92%
CREATIVITY	2,81%
ELECTRICAL/ELECTRONIC	2,55%
PROBLEM SOLVING	1,95%
CRITICAL THINKING	1,93%
IOT & CLOUD	1,91%
ENTREPRENEURSHIP	1,89%
MAINTENANCE	1,76%
MECHATRONICS	1,15%
OPTIMIZE ACTIVITIES	1,08%
AFTER-SALES SERVICES	0,92%
DIGITAL NETWORKS	0,91%
ELECTRIC MOTORS	0,86%
AUTOMATION/ROBOTICS	0,85%
SUSTAINABILITY	0,70%
ELECTROCHEMICAL	0,67%
SOFTWARE DEVELOPMENT	0,61%
PROJECT MANAGEMENT	0,58%
PRODUCTION ORGANIZATION	0,57%
CHANGE MANAGEMENT	0,56%
MANAGEMENT & LEADERSHIP	0,54%
3D PRINTING	0,46%
CONNECTIVITY	0,45%
SYSTEM INTEGRATION	0,44%
ALTERNATIVE ICE POWERTRAINS	0,42%
ARTIFICIAL INTELLIGENCE	0,41%

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SKILLS	% GRADUATES (per year)
RESILIENCE	0,41%
SYSTEM ARCHITECTURE	0,40%
NETWORKING	0,39%
PREDICTIVE MAINTENANCE	0,39%
SPECIFIC MANUF.ING PROCESSES	0,35%
BATTERIES	0,34%
DESIGN	0,32%
DRIVETRAIN	0,32%
ENERGY MANAGEMENT	0,31%
SALES	0,30%
BIG DATA/DATA ANALYTICS	0,27%
MOBILITY SERVICES	0,26%
AUTOMATED DRIVING	0,26%
POWER ELECTRONICS	0,25%
CYBERSECURITY	0,21%
TESTING/VALIDATION	0,21%
THERMAL MANAGEMENT	0,21%
INTERNAL LOGISTICS	0,09%
SIMULATION	0,09%
R&D&I	0,09%
MARKET ANALYSIS	0,05%
VIRTUAL PRDCT DEV. & TESTING	0,03%
DIGITAL TWINS	0,00%

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