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2019-2023

D4.2 Survey results for sub-sector Stationary and other Industrial Applications of Batteries

24/02/2021

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About Survey Deliverable

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Executive Summary (I/II)

The survey was open **from 7. 12. 2020 to 10. 2. 2021**. We promoted it by using social media and with an email campaign targeting ALBATTS project stakeholders. Additionally, we reached out to the members of the DRIVES project. A telesales approach was also applied by contacting selected stakeholders by phone and sending them information about the survey by email afterwards.

A total of **98 responses** were received that were qualified to be used for the survey results analysis. The top three countries from where we received responses are Finland, Portugal and Czech Republic.

Most **respondents** categorised themselves as companies, followed by educational institutions and technology centres. According to the **NACE codes** of the respondents, the highest number of them belong to „manufacturing of batteries and accumulators“, „manufacturing of motor vehicles“ and „maintenance and repair of motor vehicles” categories. In terms of where the respondents belong in **the supply chain**, „components and cell manufacturing“ is the most strongly represented, followed by „raw materials and processing“.

According to the survey data the most significant drivers of change within the battery sector are „climate goals, regulation and environmental challenges”. „Reducing CO^2 emissions”, “access to raw materials“, “global technical harmonization and standardization” and „cybersecurity“ are listed among the most influential factors.

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Executive Summary (II/II)

Respondents were asked to rank the importance of different **job roles** related to the battery value chain stages. The job roles had been identified with the desk research work conducted earlier in the ALBATTS project. **Engineering** job roles in such battery related areas as material, design, systems, process, manufacturing and recycling ranked the highest. **Technicians** working in such fields as testing, cell inspection, maintenance, servicing, dismantling and recycling as well as **quality specialists** and **software developers** were ranked high as well**. Safety managers** along with experts on fire rescue and risk mitigation are in demand as well.

The highest ranking **soft and transversal skills and knowledge** are problem-solving and troubleshooting, teamwork and computer literacy. Among the **sector specific skills and knowledge,** the highest ranking are embedded systems, identifying process improvement, BMS, use of CAD software, algorithms , developing models and handling dangerous goods.

Attractiveness of the battery sector was also evaluated by the responders: innovation and key technologies followed by focus on sustainability were regarded as the most important based on their ranking**.** The **Other findings** section include data about how challenging it is to find battery-skilled employees and whether they are going to be hired by the respondent in the near future, as well as whether it is considered that more safety-related skills are needed.

The survey and the data it generated will continue to be **analysed** in the continuing research conducted by the ALBATTS project. The results of our research work can be followed on the ALBATTS website.

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Introduction

The Alliance for Batteries Technology, Training and Skills (ALBATTS) is a European Erasmus+ funded project with the objective of contributing to the electrification and green energy proliferation in Europe, by designing a blueprint for competences and training schemes of the future in the battery sector.

The survey is a tool that ALBATTS partners use to gather information from stakeholders and it follows the main findings of the previous deliverable D4.1. The goals of D4.1 included mapping the current state of the art of mobile battery applications sub-sector which will be then used for the gap analysis.

The survey was part of the intelligence activities: the main goal was to gather information about job roles and skills needed to build a complete battery value chain in Europe. This included enterprises along the battery storage value chain, European workers disrupted or highly affected by the change, educational providers, decision makers and general public.

Information gathered by this survey will be further processed and analysed in D3.4 - Survey Results for Battery Sector report, and when forming the sectoral intelligence deliverable, which is ultimately the roadmap for the battery sub-sector.

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Methodology and Respondents

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Methodology

The stakeholders involved in the survey have been mapped according to the battery's supply chain:

- **Raw materials and processing:** primary material sourcing with emphasis on rare earths and scarce metals. In the future, also integration of the recycled materials coming from end-of-life batteries into the production stream.
- **Components and cell manufacturing:** battery components, cell manufacturing methods.
- **Module and pack manufacturing:** creation of larger systems from battery cells and modules.
- **Battery integration:** integration of assembled battery modules together with Battery Management System into the specific use cases.
- **Operation, repair, and maintenance:** topics related to energy storage, operation, repair, and maintenance including safety issues and new emerging services.
- **Second life:** "life after life" of the batteries used e. g. as an energy storage.
- **Recycling:** re-use of the scarce materials retrieved from used batteries, in line with "circular economy" principles. Important to ensure compliance with current and upcoming legislation and to avoid harming the environment.

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Methodology

The survey is based on 5 main areas, as follows:

1. **GENERAL INFORMATION**: to characterise the respondents.
2. **DRIVERS OF CHANGE:** based on the desk-research outcomes, an evaluation of the Drivers of Change is available in this section (rating information by importance and urgency). Due to the COVID-19 pandemic situation, specific questions related to this topic have been added in this area, which was not thoroughly considered during the desk research activity.
3. **JOB ROLES:** to gather valuable data on current and future job roles, competences, skills, and knowledge needs; to better understand the current situation of the fast-emerging battery sector and validate the desk research results.
4. **SKILLS:** following the previous section, if the respondent decides to "analyse" a specific Job Role, this area allows rating and suggesting skills for the chosen Job Role. Specific calculation of the skills index was done during the analysis.
5. **ATTRACTIVENESS OF THE SECTOR**: to better understand the current situation of the sector, by focusing on target groups which include primarily potential newcomers to the sector and also workers from other sectors who are eventually considering entering this growing industry.

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KPIs

KPIs used to map the outcomes refer to the 5 above mentioned areas of the questionnaire:

#	CATEGORY	KPI	INDICATOR TITLE	UOM	ISIBA / IMBA	SUPPLY CHAIN STEPS
1	SAMPLE CHARACTERISATION	1.1	N° OF RESPONDENTS	N°	X	
1	SAMPLE CHARACTERISATION	1.2	TYPE OF ORGANISATION	%	X	
1	SAMPLE CHARACTERISATION	1.3	NACE CODE	%	X	
1	SAMPLE CHARACTERISATION	1.4	SUPPLY CHAIN COVERAGE	%	X	
1	SAMPLE CHARACTERISATION	1.5	RESPONDENTS PER COUNTRY	%	X	
2	DRIVERS OF CHANGE	2.1	IMPORTANCE OF DRIVERS OF CHANGE GROUPS - MACROCATEGORY	%	X	
2	DRIVERS OF CHANGE	2.2	URGENCY OF DRIVERS OF CHANGE GROUPS - MACROCATEGORY	%	X	
2	DRIVERS OF CHANGE	2.3	DoC CLIMATE GOALS, REGULATION, AND GREEN ENERGY - IMPORTANCE	%	X	
2	DRIVERS OF CHANGE	2.4	DoC CLIMATE GOALS, REGULATION, AND GREEN ENERGY - URGENCY	%	X	
2	DRIVERS OF CHANGE	2.5	DoC GLOBALIZATION - IMPORTANCE	%	X	
2	DRIVERS OF CHANGE	2.6	DoC GLOBALIZATION - URGENCY	%	X	
2	DRIVERS OF CHANGE	2.7	DoC NEW TECHNOLOGIES - IMPORTANCE	%	X	
2	DRIVERS OF CHANGE	2.8	DoC NEW TECHNOLOGIES - URGENCY	%	X	
2	DRIVERS OF CHANGE	2.9	SUGGESTED DRIVERS OF CHANGE AND ADDITIONAL QUESTIONS	OTHER	X	
3	JOB ROLES & SKILLS	3.1	JOB ROLES AND ADDITIONAL QUESTIONS	OTHER	X	X
3	JOB ROLES & SKILLS	3.2	SUGGESTED JOB ROLES	OTHER	X	
3	JOB ROLES & SKILLS	3.3	SKILLS INDEX	INDEX	X	
4	ATTRACTIVENESS	4.1	ATTRACTIVENESS FACTORS	%	X	
4	ATTRACTIVENESS	4.2	ATTRACTIVENESS OTHER QUESTIONS	%	X	
5	COVID-19	5.1	COVID-19 EFFECT	%	X	

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Sample Characterization

Part or all of the survey was completed by **98 respondents**. Inclusion for further analysis was based on the criteria that only those respondents completing at least the **3. Job Roles** section were included. Respondents identified themselves as:

- **43 respondents** as active in **both** mobile and stationary and other industrial applications of batteries sub-sector
- **37 respondents** as active in **mobile applications** of batteries sub-sector
- **18 respondents** as active in **stationary and industrial battery applications** of batteries sub-sector

This deliverable describes the results for **stationary and industrial battery applications** sub-sector where **61** responses were processed.

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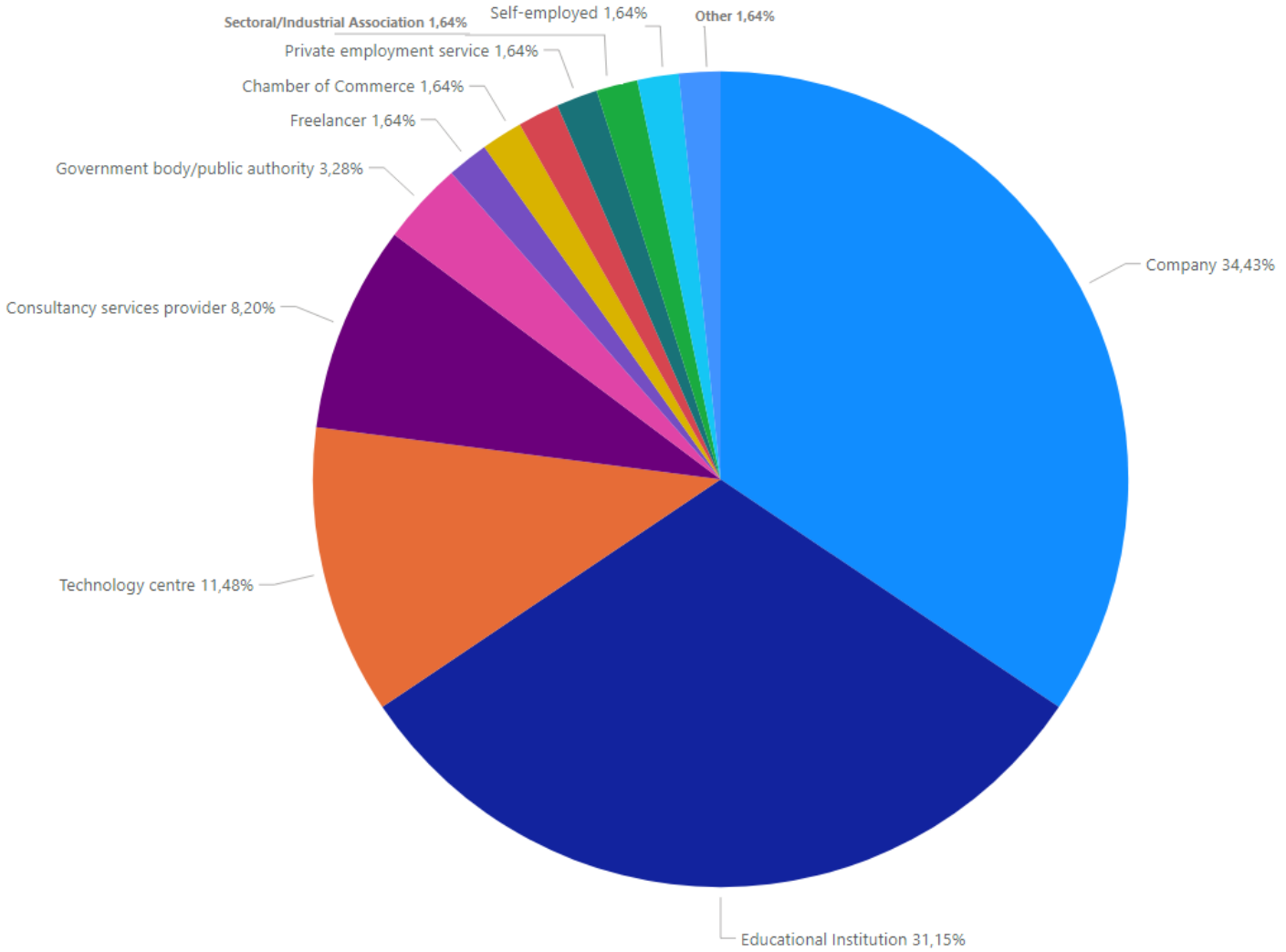
Type of Organisation

The majority of respondents belong to **companies** (34,43%), followed by **educational institutions** (31,15%).

Other stakeholders come from **technology centres** (11,48%), **consultancy service providers** (8,2%), **government bodies** (3,28%) as well as **public authorities** to a minor extent.



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NACE Codes

The NACE codes are a European Industry-standard classification system similar in function to Standard Industry Classification (SIC) for classifying business activities.

Following list of NACE codes was used for sample characterization:

- C2920 Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
- C2931 Manufacture of electrical and electronic equipment for motor vehicles
- C2932 Manufacture of other parts and accessories for motor vehicles
- C3011 Building of ships and floating structures
- C3012 Building of pleasure and sporting boats
- C3091 Manufacture of motorcycles
- E3812 Collection of hazardous waste (collection of hazardous waste, such as used batteries)
- E3832 Recovery of sorted materials (recovery of materials from waste streams... or the separating and sorting of commingled recoverable materials.... shredding of metal waste, end-of-life vehicles)
- G4511 Sale of cars and light motor vehicles
- G4519 Sale of other motor vehicles
- G4531 Wholesale trade of motor vehicle parts and accessories
- G4532 Retail trade of motor vehicle parts and accessories
- G4540 Sale, maintenance and repair of motorcycles and related parts and accessories
- G4764 Retail sale of sporting equipment in specialised stores (ships, boats…)

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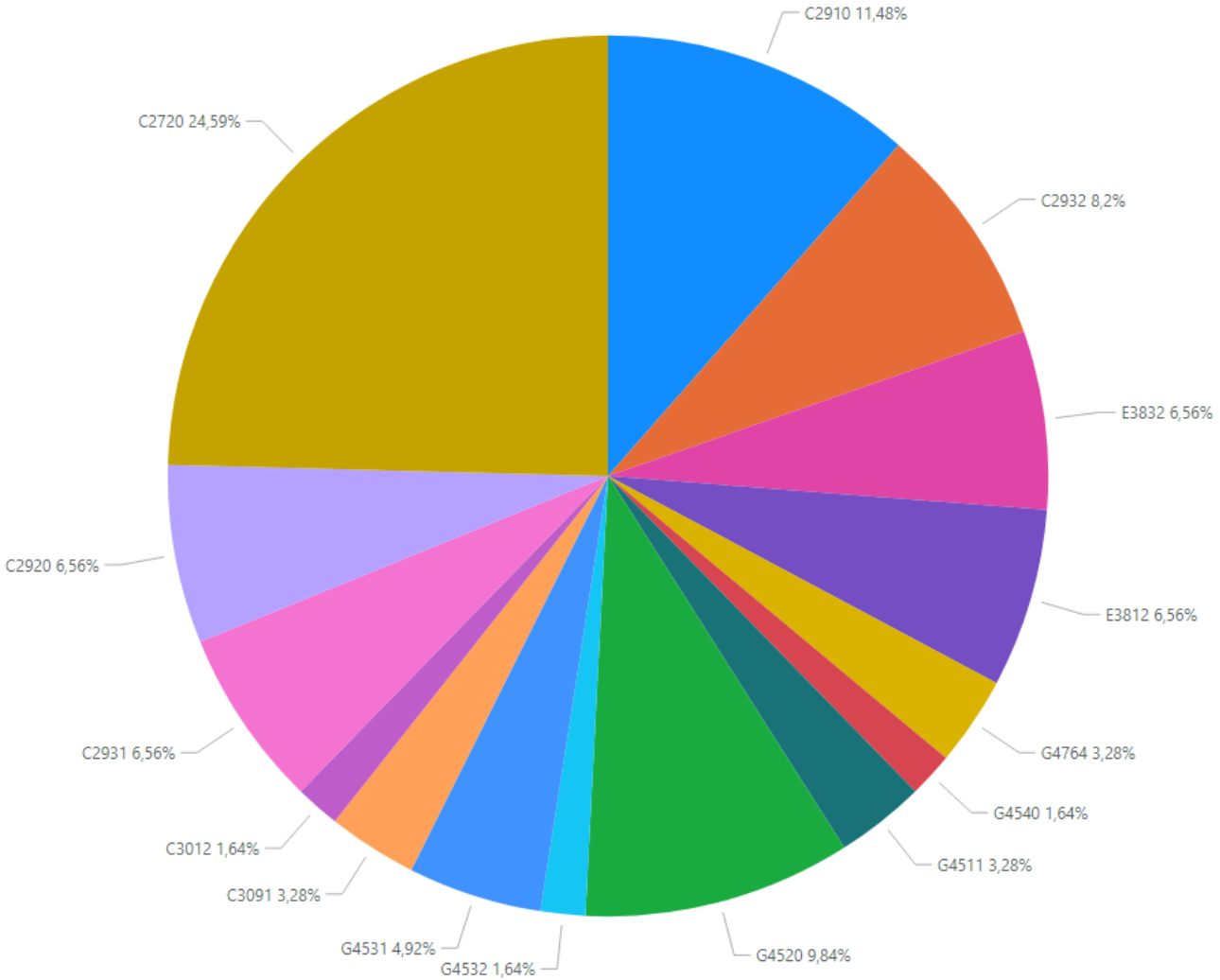
NACE Codes

With reference to NACE Codes, most of the respondents refer to **C2720 Manufacture of batteries and accumulators** (24,59%), followed by **C2910 Manufacture of motor vehicles** (11,48%) and **G4520 Maintenance and repair of motor vehicles (electrical repairs, repair of motor vehicle parts – battery)** at 9,84%.



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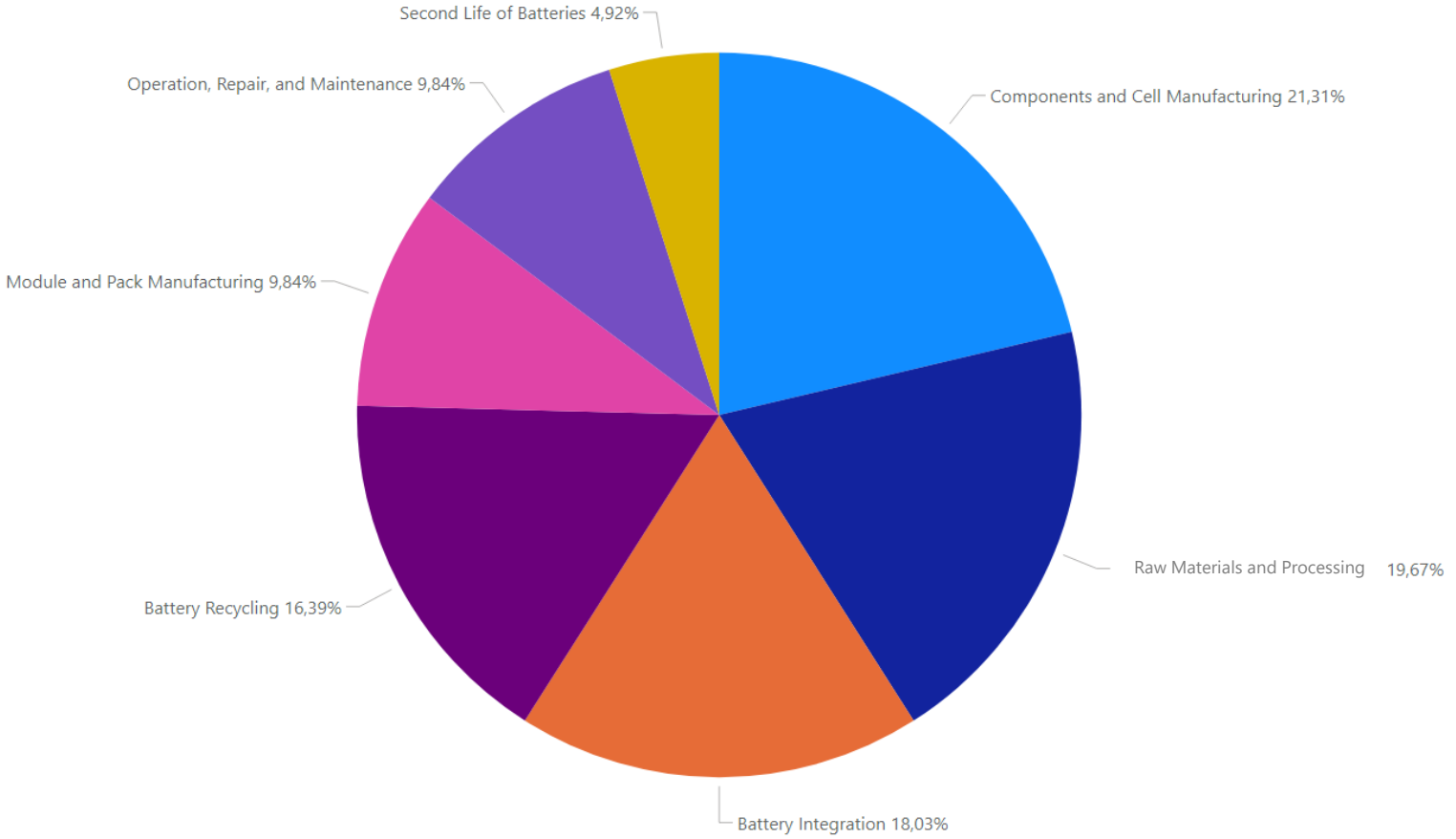
Supply Chain Coverage

As for the supply chain coverage, we see that **components and cell manufacturing** is the most frequent (21,31%), followed by **Raw Materials and Processing** (19,67%).



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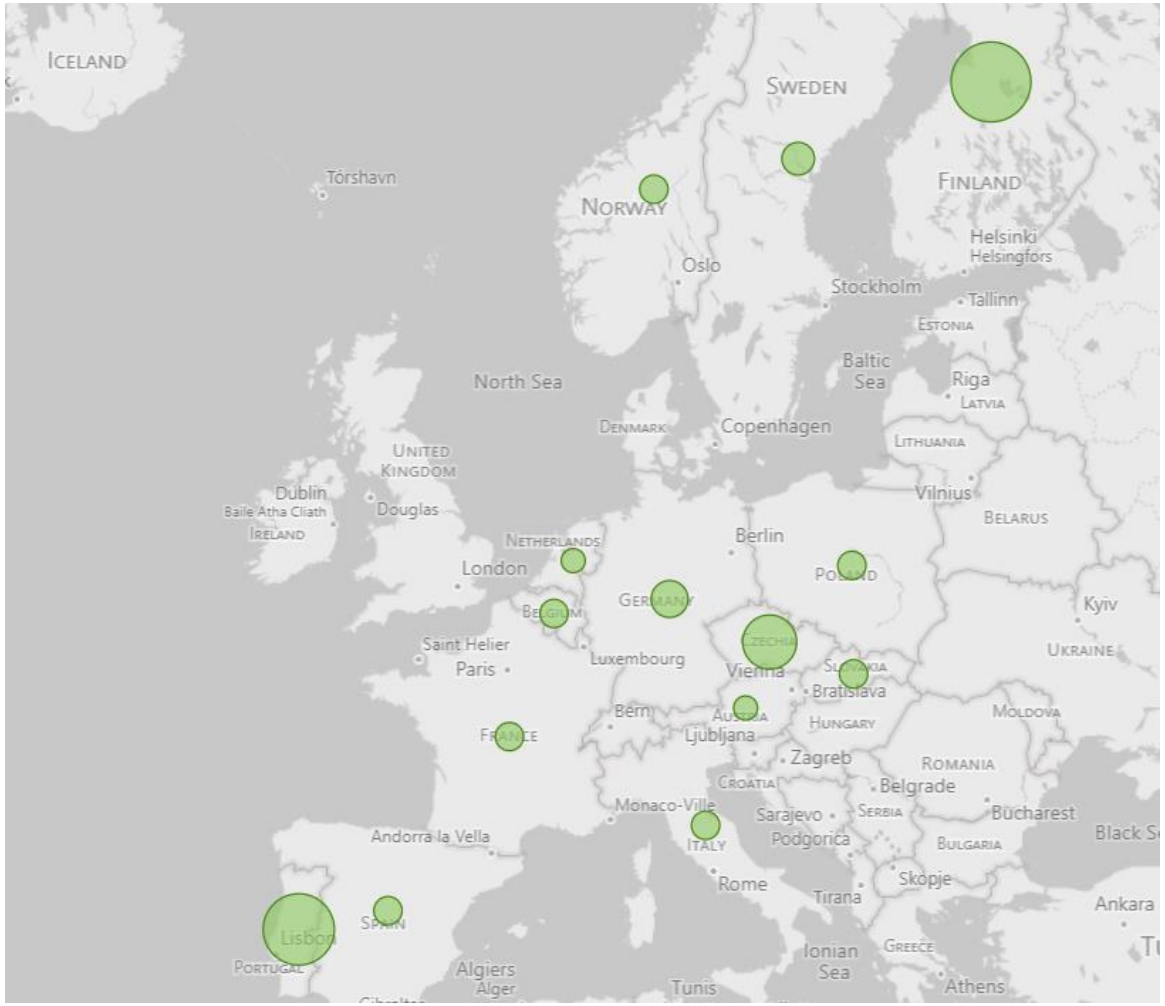
Respondents per Country

When focusing on Europe, the majority of respondents come from **Finland** (22,95%) **Portugal** (19,67%) and **Czech Republic** (13,11%).



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Drivers of Change

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Drivers of Change

Drivers of Change are those factors which are going to bring change and have an impact on a sector across different levels. To do this, the 3 following macro categories of drivers of change have been identified:

- **New technologies**: the need for urgent and intense actions against climate change are widely recognized and batteries are an essential system for storing energy and making renewable energy a reliable alternative source.
- **Globalisation**: over the next years, production in global markets for batteries is expected to grow strongly and the EU production must completely change its position to create a competitive advantage.
- **Climate goals, regulation and environmental challenges**: batteries are one of the most important climate targets driver to decarbonization and support the transition to a renewable power system.

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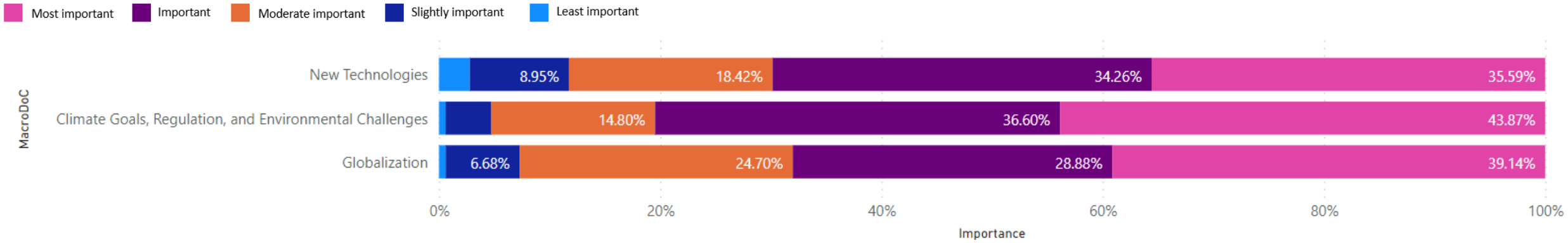
Drivers of Change – Macro Category - Importance

A matrix with the three above mentioned macro categories was proposed, and respondents were asked to evaluate them based on their importance (1 not important – 5 very important). The results show that **climate goals, regulation and environmental challenges** is perceived as the most important category (43,87% rated it with “5”). However, we also see that **new technologies** and **globalization**, although less voted, are still important and shall be taken into consideration.



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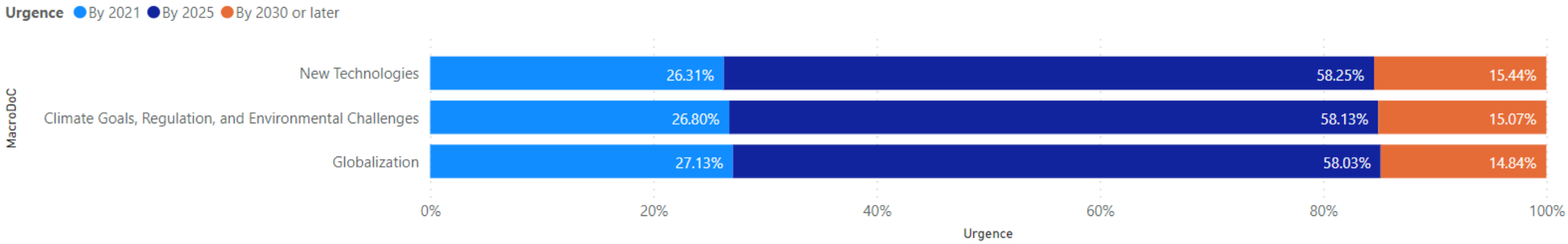
Drivers of Change – Macro category - Urgency

A similar matrix has been applied also regarding the perceived urgency of the drivers of change (whether the macro category shall be addressed by 2021, 2025 or by 2030 or later). The results show that the urgency of all these macro categories is very equal.



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Drivers of Change – Sub-category – Climate Goals, Regulation, and Environmental Challenges

Batteries are one of the most important climate targets drivers to decarbonization and support the transition to a renewable power system. Within the climate category, we can identify 3 sub-categories:

- **Electrification and green energy**: Batteries can fundamentally reduce greenhouse gas emissions in energy industry and therefore play an increasingly important role as a systemic enabler of a major shift to greenhouse gas neutrality**.**

- **Reducing CO_2 emissions from battery manufacturing**: since the production of batteries requires significant amounts of energy, an increase in the share of renewable energies and energy efficiency in the battery value chain would be a major step for decreasing CO_2 emissions from battery production.

- **Widespread charging/refuelling infrastructure**: demand for widespread charging infrastructure is a key driver to boost the commercialization of a technology based on batteries. The easier the access to a reliable and suitable charging infrastructure is, the quicker the development of such new technologies will be.

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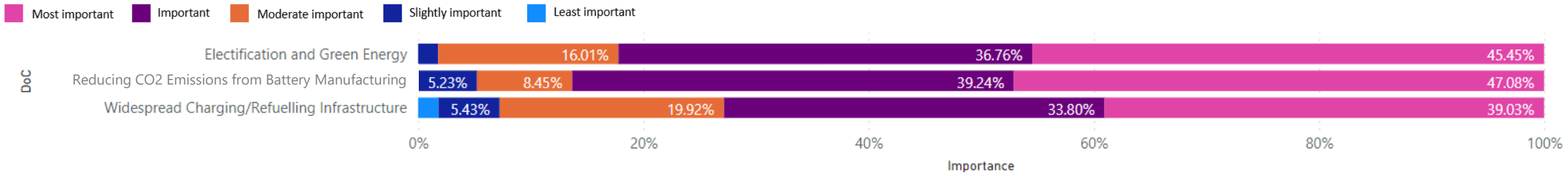
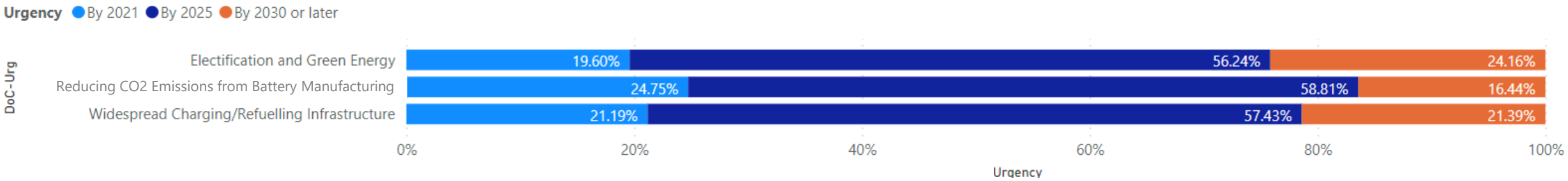
Drivers of Change – Sub-category – Climate Goals, Regulation, and Environmental Challenges

Within the climate category, we see that for respondents it is more important to focus on **reducing CO2 emissions** (47,08%), though there is not a big gap with the other sub-categories (45,45% for **electrification and green energy** and 39,03% for **widespread charging infrastructure**).



Similarly, it is more urgent (by 2021) to focus on **reducing CO2 emissions** (24,75%). **Electrification** is the one to focus on in the longer term (by 2030 or later).



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Drivers of Change – Sub-category – Globalization

Over the coming years, production in global markets for batteries is expected to grow strongly and the EU production must completely change its position to create a competitive advantage. Within the globalization category, we can identify 3 sub-categories:

- **Access to raw materials**: with a rapid increase in numbers of batteries, 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.

- **Global regulatory dialogue**: The Commission and in general, Governments and public administrations in Europe will need to play a fundamental role in the elaboration of policies and strategies, from which the battery sector could benefit.

- **Restructuring**: sectors related to the emerging battery sector are expected to undergo structural changes due to the development of zero-emission ecosystem and as a flexible facilitator of intermittent renewable energy sources.

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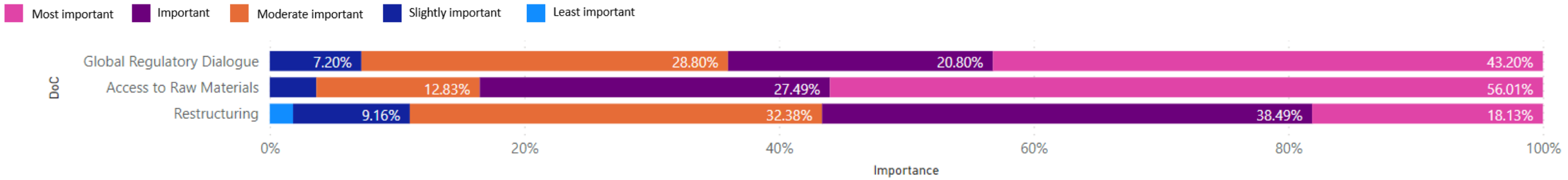
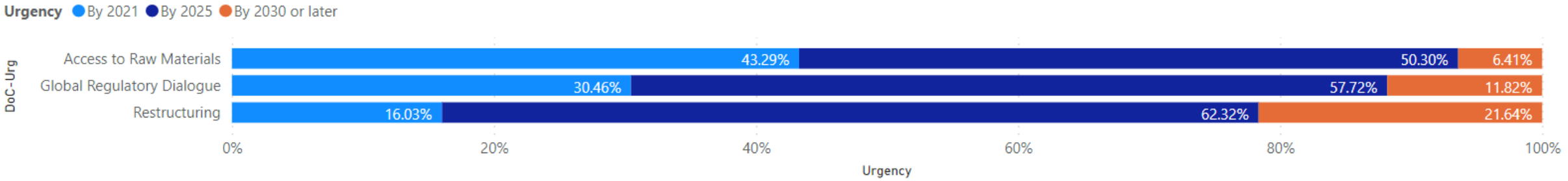
Drivers of Change – Sub-category – Globalization

Within the globalization category, we see that for respondents it is more important to focus on **access to raw materials** (56,01%), followed by **global regulatory dialogue** (43,2%).



Similarly, it is more urgent (by 2021) to focus on **access to raw materials** (43,29%).



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Drivers of Change – Sub-category – New Technologies

The need for urgent and intense actions against climate change are widely recognized and batteries are an essential system for storing energy and making renewable energy a reliable alternative source. Within the new technologies category, we can identify 3 sub-categories:

- **Cybersecurity**: exponential growth of IoT devices connected to a network, cloud infrastructures as well as the navigation and location information can compromise customer privacy and security, requiring providers to keep communications secure. This threat landscape requires the industry to modify the security approach, aimed at guaranteeing the resilience of the infrastructures to cyber-attacks. That will affect various battery applications in the future.

- **Global Technical Harmonisation, Standardisation**: the supply chain structure within the sector will need to meet the challenges posed by the introduction of new technology but also meet changing market conditions.

- **Smart Grid**: storage is one of the most important smart grid components due to its key role in complementing renewable energy generation. With the proper amount and type of storage broadly deployed and optimally controlled, renewable generation can be transformed from an energy source into a dispatchable generation source.

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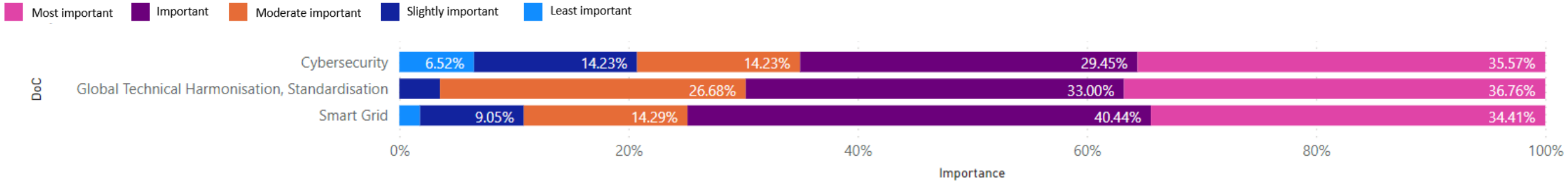
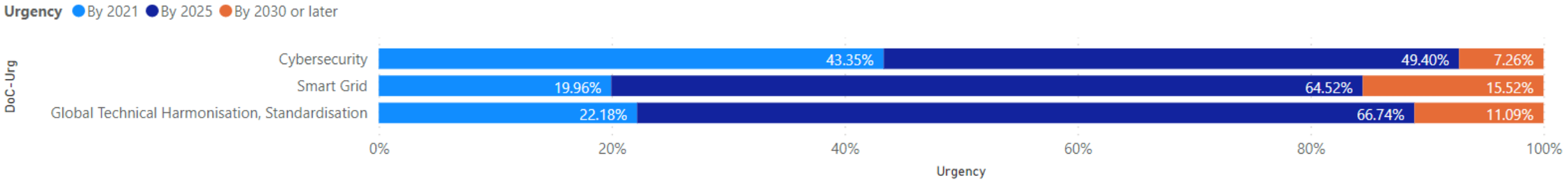
Drivers of Change – Sub-category – New Technologies

Within the new technologies category, we see that for respondents it is more important to focus on **global technical harmonization, standardization,** (36,76%), though there is not a big gap with the other sub-categories (35,57% for **cybersecurity** and 34,41% for **smart grid**).



It is urgent (by 2021) to focus on **cybersecurity** (43,35%), whereas **smart grid** and **global technical harmonization, standardization** are perceived as more urgent to address by 2025.



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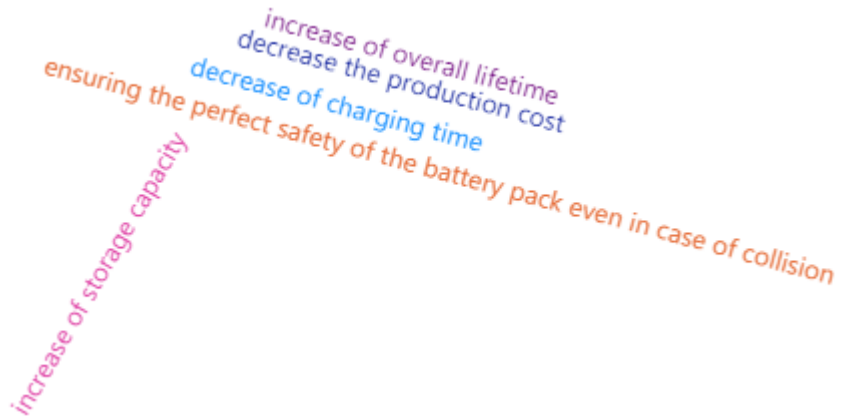
Additional Questions

As part of the drivers of change section, we asked respondents some other questions on more specific topics.

We investigated **what needs to be improved on batteries in the future.**



We investigated the most urgent **challenges of battery recycling**.

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Other Drivers of Change

Respondents were also asked to list other drivers of change that they perceived as important and urgent to focus on. As we can see in the image, there are a number of suggestions: some of them can refer to the macro categories described above (e.g. materials sustainability), whereas others can belong to other categories (e.g. interest of consumers).

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Job Roles and Skills

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Section 3 – Job Roles and Skills

The section analyses responses concerning job roles relevant to the sub-sector.

Within the survey, respondents were asked to select one **value chain stage** they are active in.
Then they evaluated **importance** (**1 – least important**; **5 – most important**) in a list of possible job roles, which had been put together within the previous project activities, particularly the deliverable *D4.1 - Desk research and data analysis for sub-sector ISIBA - Release 1.*
If they ticked „Analyse“, they had the possibility to proceed with a deep analysis of the necessary **skills** related to the job role.

Skills have been divided into 3 groups:

- **Soft Skills** are a combination of people skills, social skills, communication skills, character or personality traits, attitudes, career attributes, social intelligence and emotional intelligence quotients, among others, that enable people to navigate their environment, work well with others, perform well, and achieve their goals with complementary hard skills.
- **Transversal Skill** is an ability or expertise which may be used in a variety of roles or occupations. Examples include communication, problem-solving and self-control.
- **Sector Specific Skills** are particular or specialised skills necessary to perform particular jobs in specific sectors.

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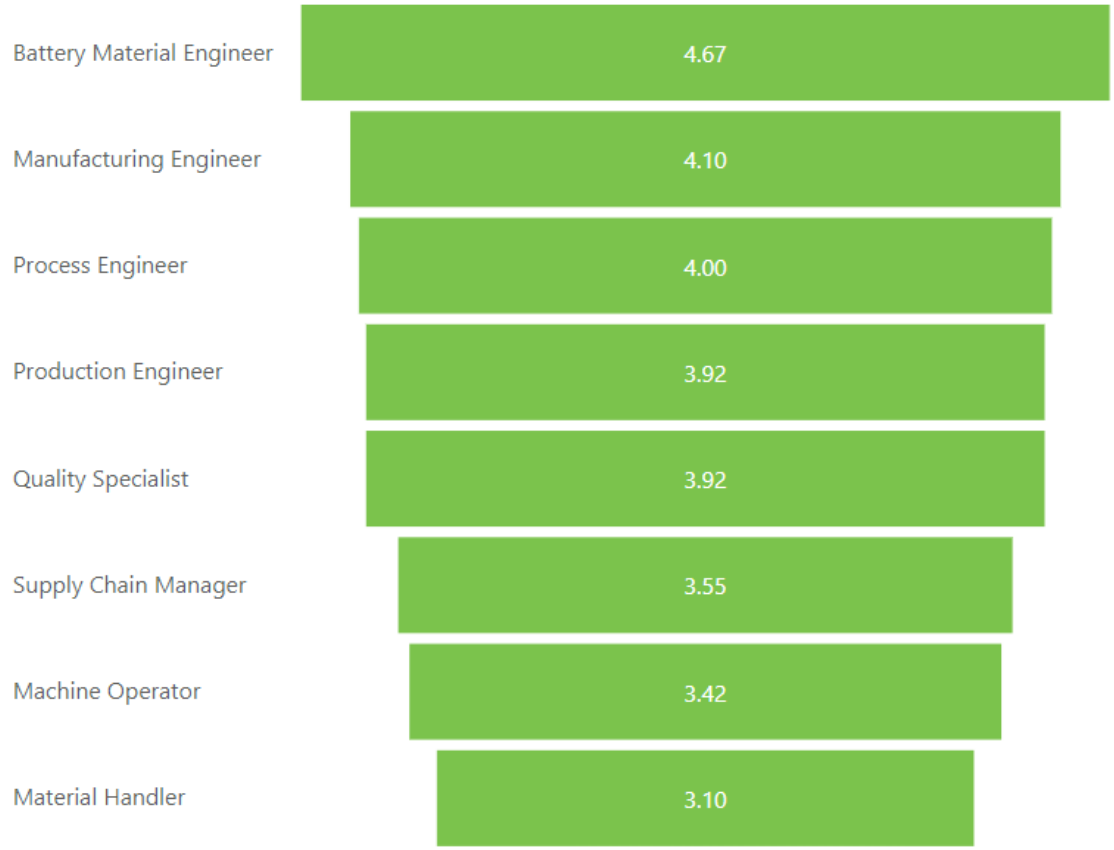
Raw Materials and Processing – Job Roles Importance

In this figure you can see the list of the most voted for job roles within "**raw materials and processing**" according to their perceived importance (1 – least important; 5 – most important).



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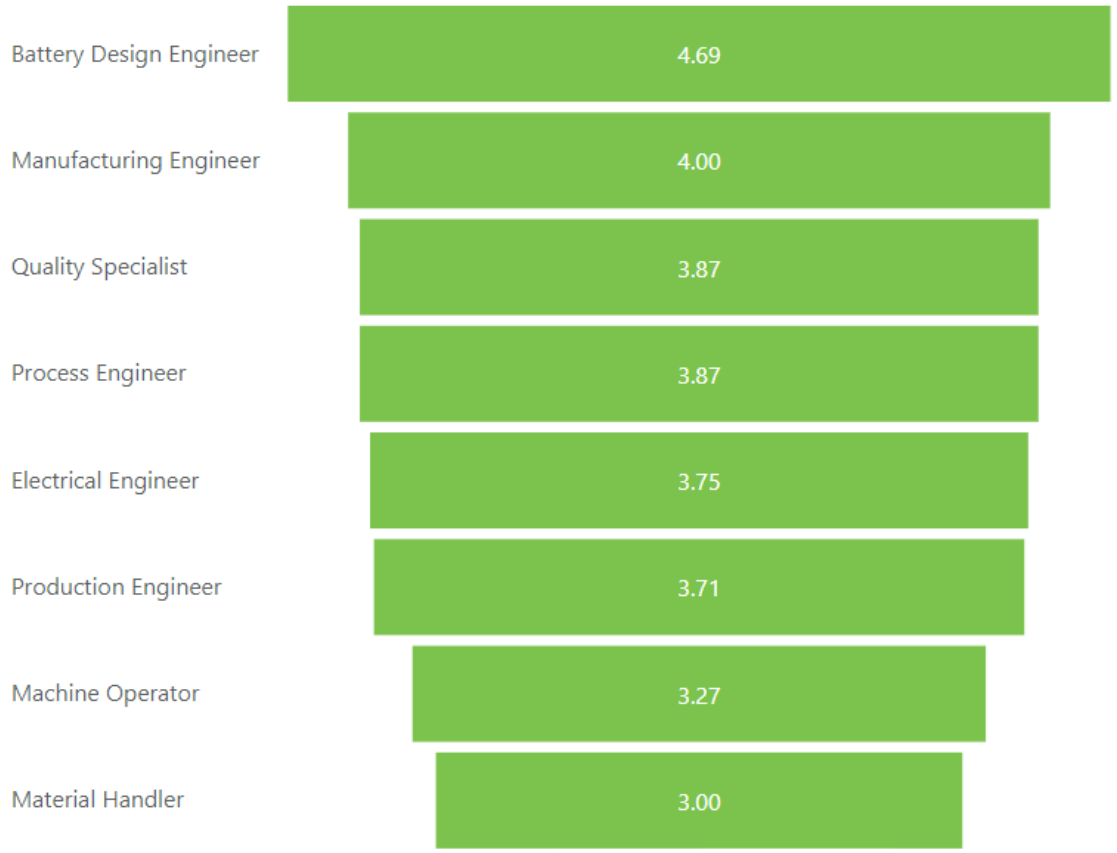
Components and Cells Manufacturing – Job Roles Importance

In this figure you can see the list of the most voted for job roles within "**components and cells manufacturing**" according to their perceived importance (1 – least important; 5 – most important).



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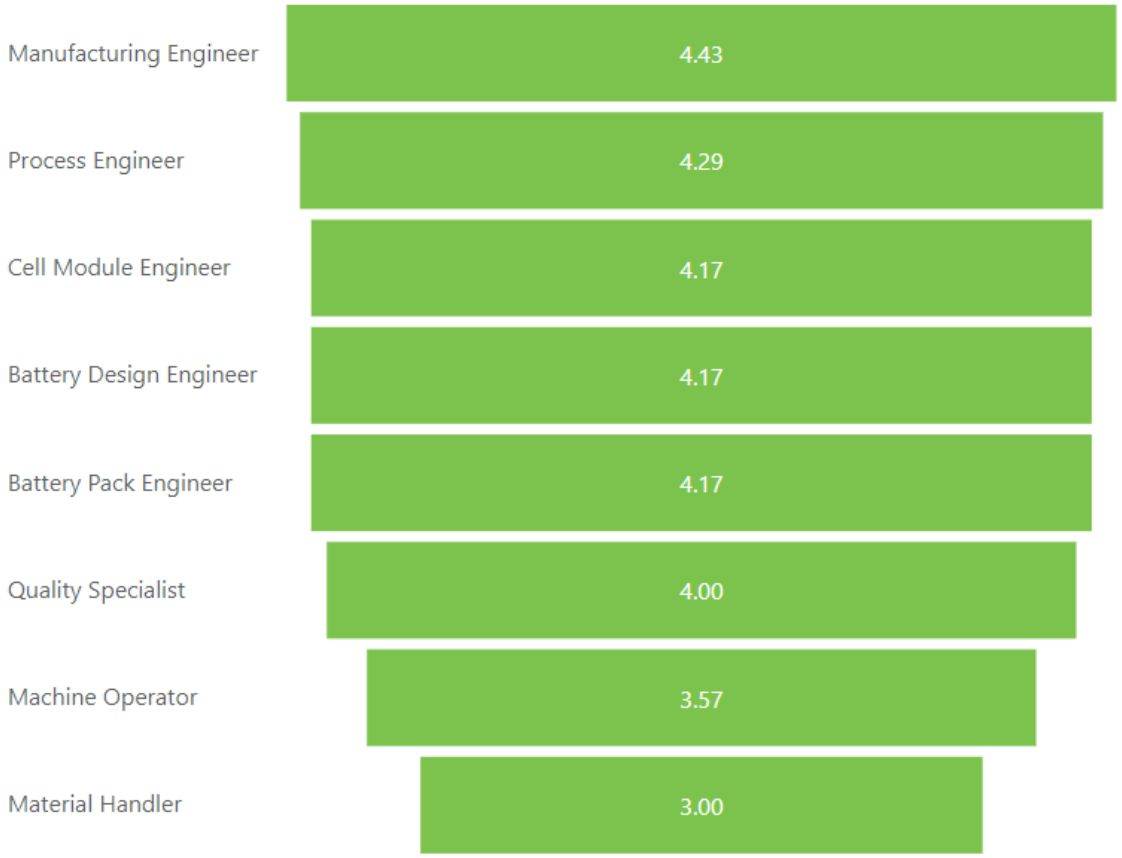
Module and Pack Manufacturing – Job Roles Importance

In this figure you can see the list of the most voted for job roles within "**module and pack manufacturing**" according to their perceived importance (1 – least important; 5 – most important).



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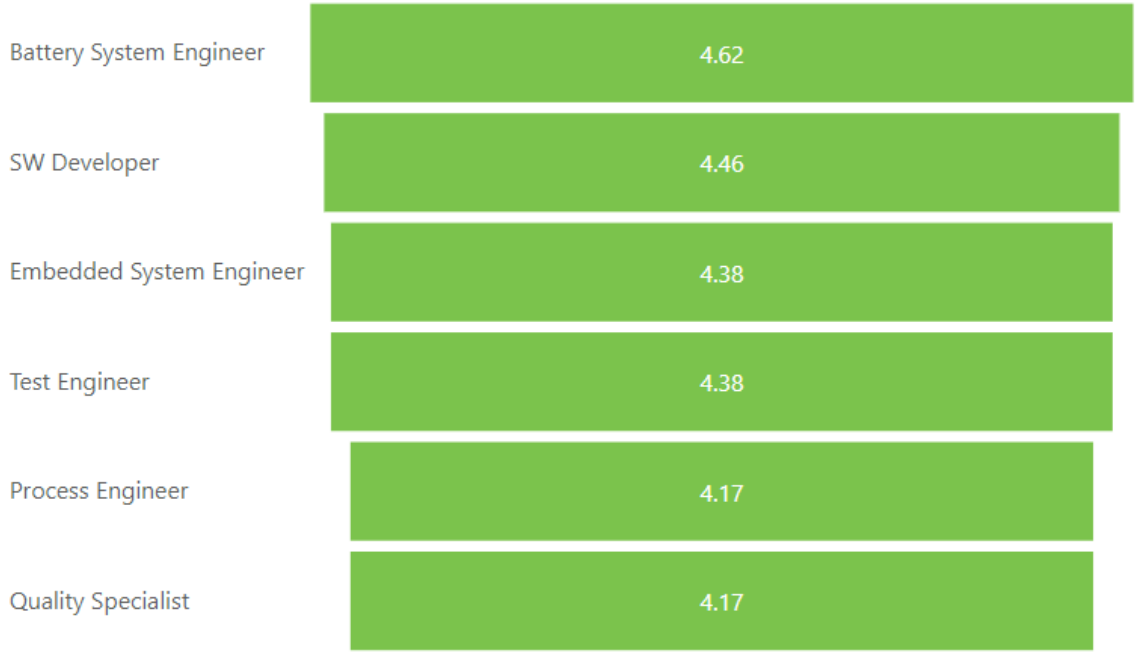
Battery Integration – Job Roles Importance

In this figure you can see the list of the most voted for job roles within “**battery integration**” according to their perceived importance (1 – least important; 5 – most important).



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Operation, Repair, and Maintenance – Job Roles Importance

In this figure you can see the list of the most voted for job roles within "**operation, repair and maintenance**" according to their perceived importance (1 – least important; 5 – most important).

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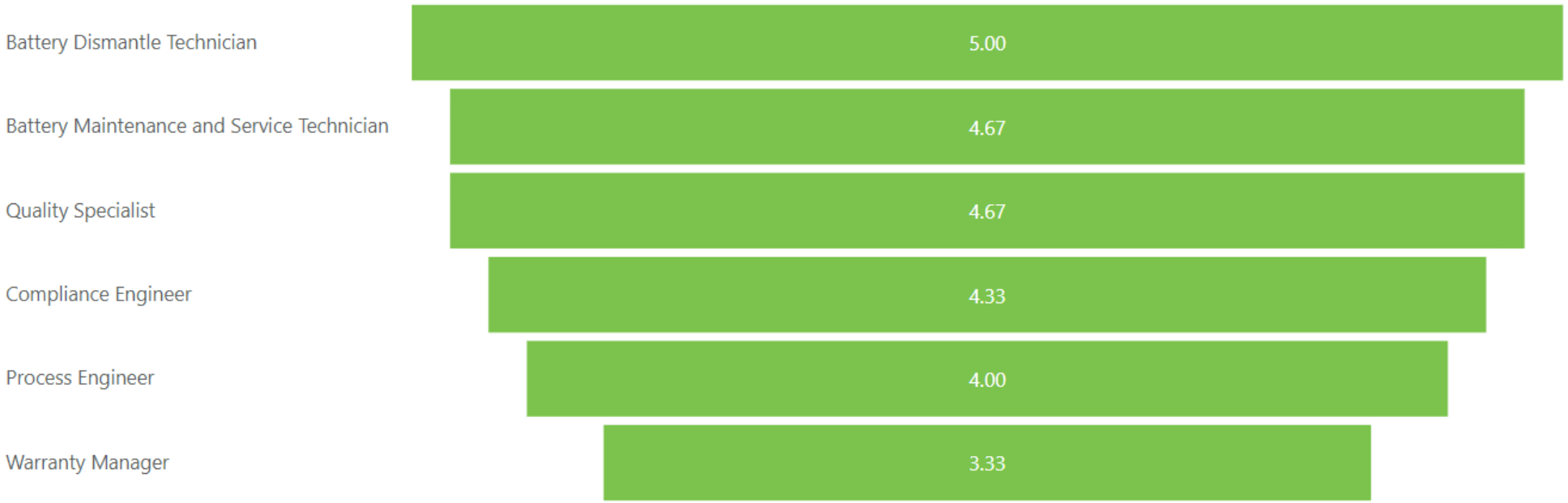
Second Life of Batteries – Job Roles Importance

In this figure you can see the list of the most voted for job roles within "**second life of batteries**" according to their perceived importance (1 – least important; 5 – most important).



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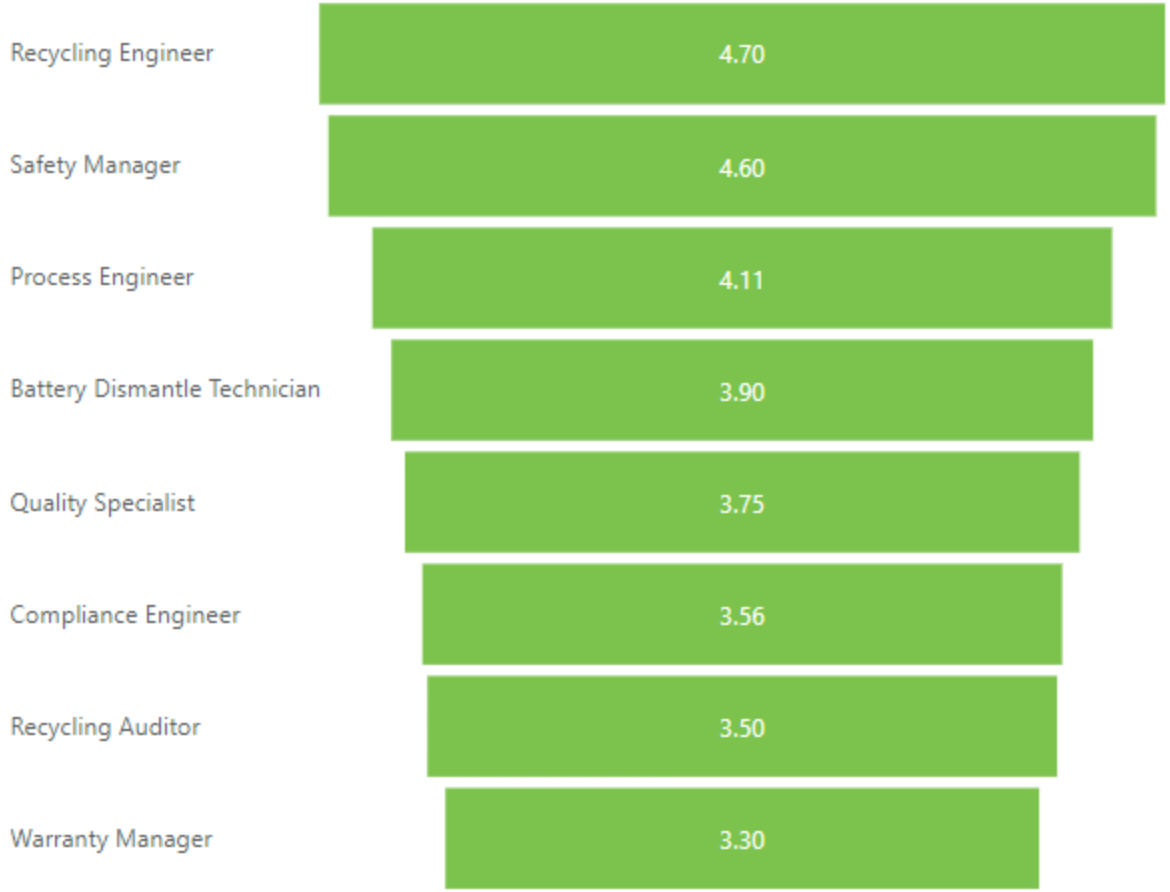
Battery Recycling – Job Roles Importance

In this figure you can see the list of the most voted for job roles within "**battery recycling**" according to their perceived importance (1 – least important; 5 – most important).



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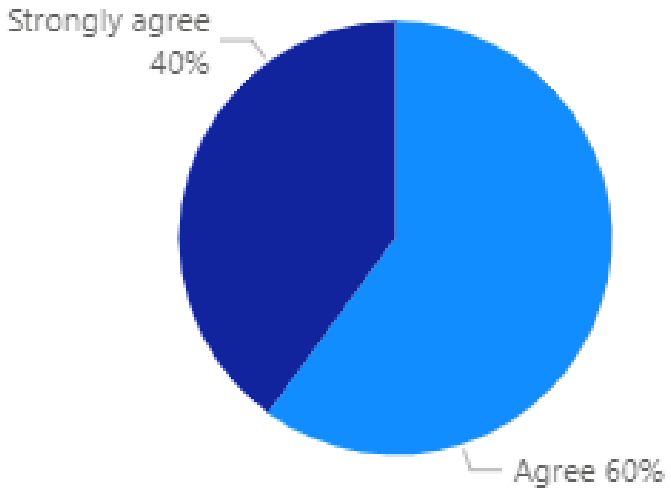
Additional Question

As part of the job roles and skills section, we asked respondents an additional question about safety.

We investigated **whether the fire rescue and risk mitigation** job roles will be needed in the future.



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Other Job Roles

Respondents were also asked to list other Job Roles considered as important for the sector. As we can see in the image, there are a number of suggestions, which can belong to the different phases of the supply chain above analyzed.

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Skills

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Skills Index Definition

Skills index is a metric to rate the importance of the skills/competences and knowledge. Respondents were shown a certain set of skills/competences and knowledge linked to a value chain stage and specific job roles, and they could rate their importance.

The skills index is calculated based on the:

- Importance average of the Job Role where it is mapped.
    - Number of times where respondents chose to “analyse” the job role further.
- Average of the importance of the calculated skill based on the respondent's evaluation.

The final results show **soft and transversal skills** sorted by the skills index as well as the **sector specific skills** for the whole sub-sector.

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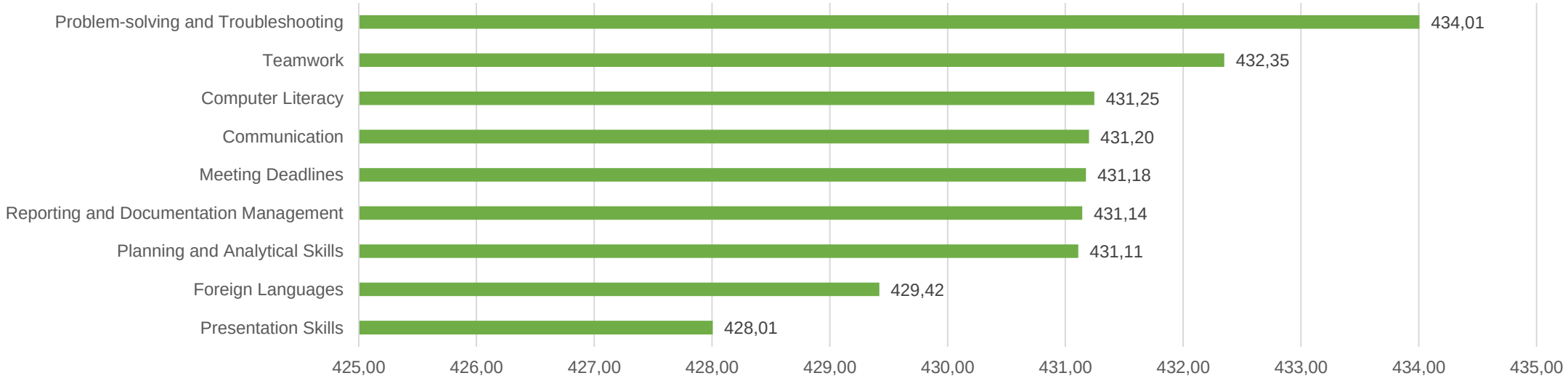
Skills Index Soft and Transversal Skills/Competence and Knowledge

Skills index calculation shows that the skills/competence and knowledge perceived by respondents as the most important are: **Problem-solving and Troubleshooting, Teamwork, Computer Literacy** and the rest is shown on the following chart.



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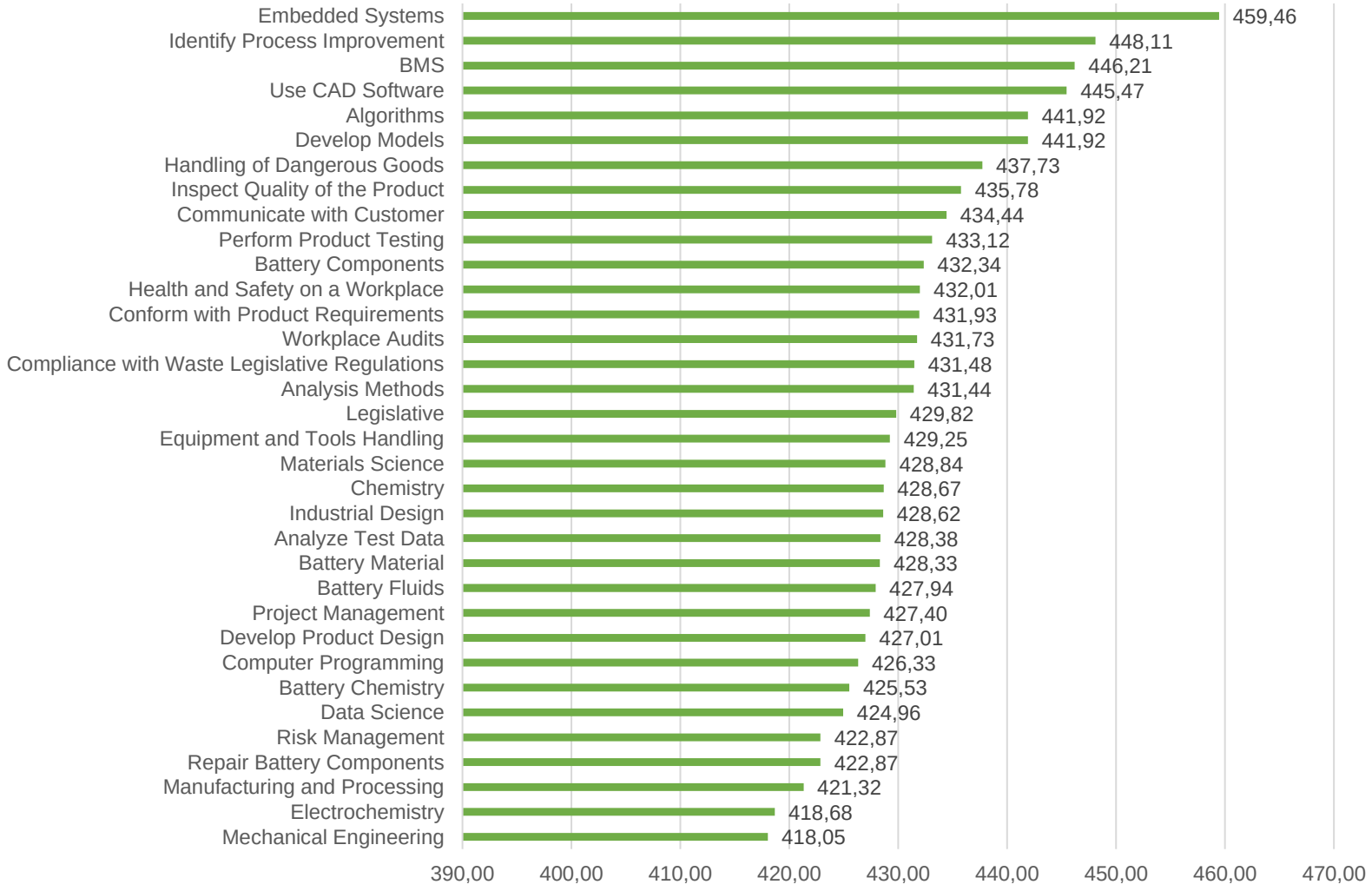
Skills Index Sector Specific Skills/Competence and Knowledge

Skills index calculation shows that the skills/competences and knowledge perceived by respondents as the most important are related to **computer programming**, **embedded battery systems**, **modelling**, **testing** and **quality**; the rest are shown in the following chart.



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Sector Attractiveness

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Sector Attractiveness

The success of a sector depends on the competitiveness of the companies that operate there, which in turn depend on the skills of the workers.

A strong attractiveness of the sector brings together skilled and talented workers within it, creating a virtuous process of success.

Therefore, to strengthen the success of the sector it is first necessary to understand how it is perceived by existing and potential workers, as well as what their preferences and priorities are.

This section analyses factors the battery sector should concentrate on to increase its attractiveness.

In the survey, a list of possible attractiveness factors was made available to the respondents for their evaluation.

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Attractiveness of the Sector – Selected Factors

The figure on the following slide shows which areas the sector shall focus on to improve its attractiveness. A matrix with some solutions was proposed and respondents were asked to evaluate them based on importance ("not at all", "less", "right amount", "more" and "much more").

Based on the results, we see that respondents evaluated as "much more" (i.e. most important) "**innovation and key technologies**" (48,08%) followed by "**focus on sustainability**" (45,1%).

It is similarly important to dedicate time and commitment to *innovation*, as we can see from the votes on "**innovative job skills**" (66,04%), "**modern learning methods**" (58,82%), as well as on "**internships and apprenticeships programmes**" (54,9%).

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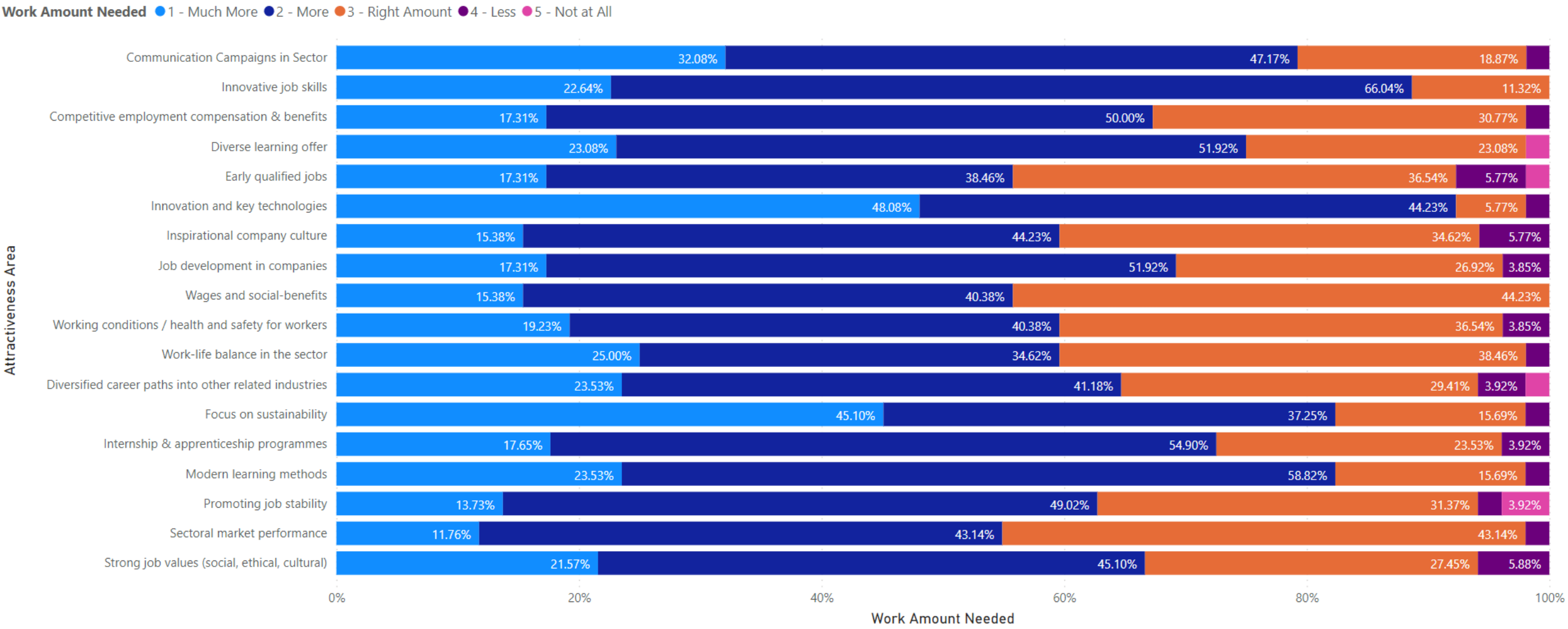
Attractiveness of the Sector – Selected Factors



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Other Findings

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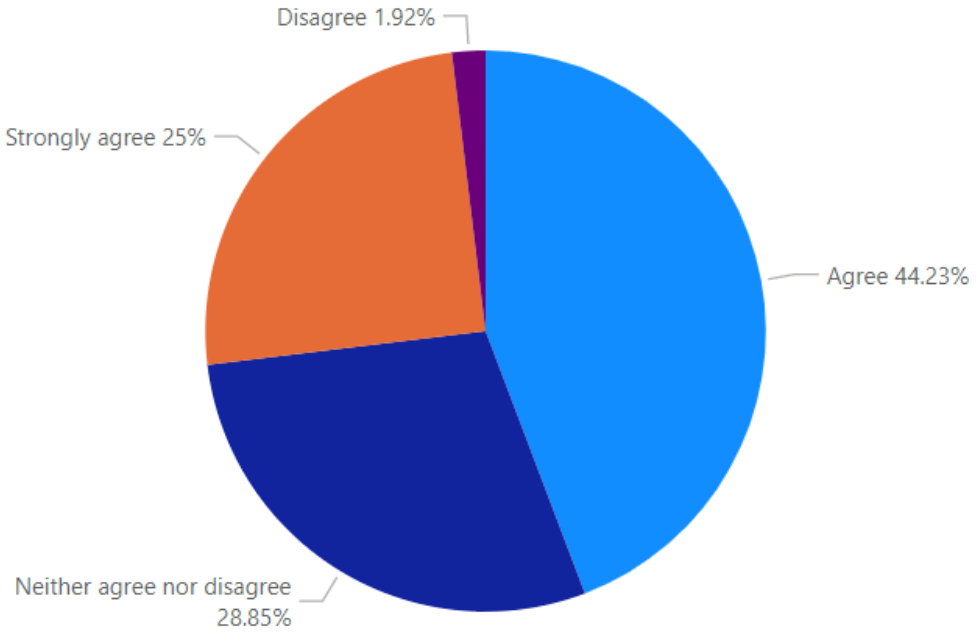
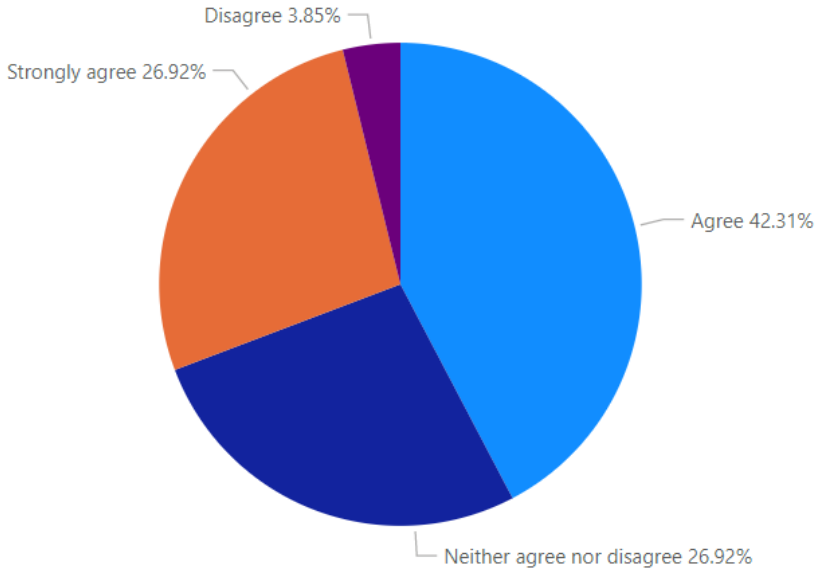
Additional Questions

As part of the attractiveness section, we asked respondents the following additional questions:

We investigated whether staff would need more skills and competences with **safety related topics**: most of the respondents **agreed or strongly agreed** on this topic



We asked whether it was **challenging to find battery related skilled and competent workforce** at the moment: most of the respondents **agreed** on this difficulty.



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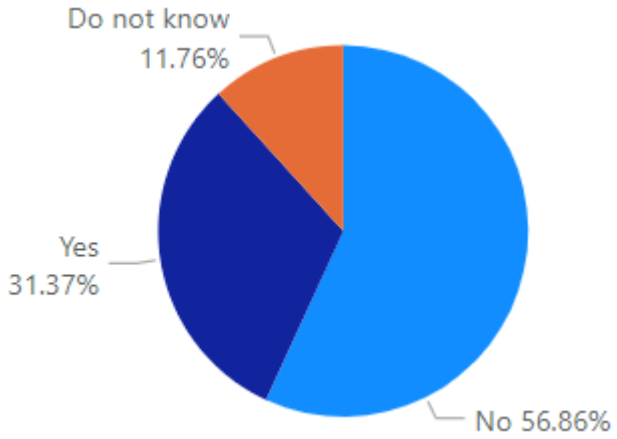
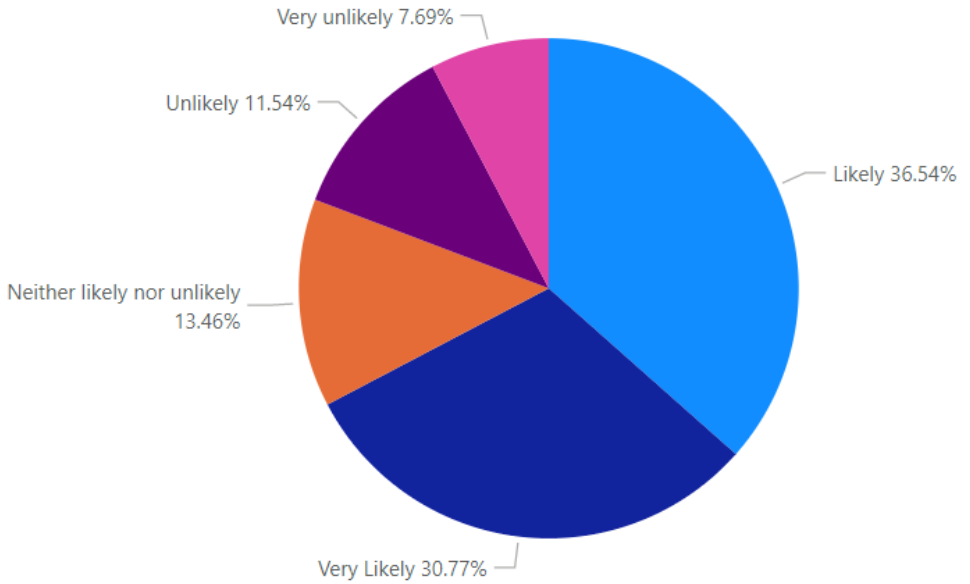
Additional Questions

We investigated if the respondent's institution **offered technical education** that provides skills and competences needed in a battery industry: 56,86% replied negatively.



We investigated if the respondent's organization would **hire more workforce with battery related skills** and competences during the next 5 years: most of the respondents said that **this is likely** (36,54%) and **very likely** (30,77%).



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Battery Related Education

In addition to the previous question about the **battery related education provision**, respondents had an opportunity to provide examples:

- Generic answers ranged from the provision of internal training for new employees, as well as seminars for externals, to industrial PhD programs as well as masters and internships.
- Topics included – recycling solutions, circular economy, materials engineering, chemical engineering and engineering physics and applied physics, electrical engineering, electrode manufacturing, environmental engineering, energy storage and energy harvest devices, renewable electricity sources.

Some examples were more specific with the description of the offered education and descriptions with the courses and seminars.

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Skills Missing

In addition to the previous question about the challenge of finding skilled and competent workforce, some respondents specified more in detail the following **skills** that are in demand:

- Industrial experience
- Batteries and project management
- Economical thinking
- Physics
- Chemistry
- Modelling
- System-level understanding
- Battery charge and discharge
- Battery repair
- Production
- Testing
- BMS
- Design
- Battery technology
- Physics engineering
- Legislation
- Electrochemistry
- IT skills
- Safety
- Regulations

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Battery Education Provision

In addition to the previous question about the challenge of finding a skilled and competent workforce, some respondents specified in more detail the covered **job roles** that are in demand:

- Battery Experts
- Data Scientists
- Software Developers
- Electrical Engineers
- Expert Process Teachers
- Materials Specialists
- Operators
- Maintenance Technicians
- Recycling Engineer
- Process Engineer

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