



Alliance for Batteries Technology, Training and Skills

2019-2023

Strategy blueprint for education and training in the sector of Batteries and Electro-mobility



Deliverable 6.8



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Author(s):	Katarina Sandbacka, Anders Norberg, João Alves, Marek Spanyolik		
Responsible Project Partner:	ATEC, Vamia	Contributing Project Partners:	VSB-TUO, Skellefteå, Vamia, ATEC

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Executive Summary

This deliverable concludes the blueprint work for education and training in the European battery and electromobility sector.

The ALBATTTS project is itself “the blueprint” for education and training in the emerging European sector and value chain, and this deliverable concentrates and concludes the education and training work, building on the background work with sectoral intelligence in the sector and value chain.

However, the blueprint metaphor stretches further into the future in different ways. Firstly, we have a number of recommendations for various target groups for strategic consideration.

Second, the ALBATTTS work, results, and European collaboration and networking are meant to continue to be developed and be useful in the future of the development of education and training for the battery and electromobility value chain. The ALBATTTS project is over, but the work continues, which we have made considerable effort to ensure by:

- the forming of a large-scale partnership under the Pact for Skills, the Automotive Skills Alliance (ASA)
- a number of different EC projects where ALBATTTS partners are engaged
- a number of national projects have begun to use the ALBATTTS results and develop these further, adapted to their country.

For further information about our Sustainability and Legacy Plan, see our deliverable 1.7¹.

¹ D1.7, ALBATTTS Sustainability and Legacy Plan, can be found linked here <https://www.project-albatts.eu/en/results>

Introduction

The EU aims to achieve ambitious environmental and energy goals, such as reducing emissions and moving towards a more sustainable economy. This is part of the European Green Deal 2 and the global commitment under the Paris Agreement 3 to be climate-neutral by 2050. The growth of the battery industry is crucial for achieving these goals by promoting the use of electric vehicles (EVs) and renewable energy storage.

To reduce Europe's reliance on imported batteries and to establish a strong position in the global battery market, the EU has implemented regulations to ensure sustainability in the battery industry, including eco-design and recycling standards. Efforts are also being made to secure a sustainable supply of essential raw materials like lithium, cobalt, and nickel for battery production, reducing the need for imports.

Some 40-50 large battery cell factories, known as gigafactories, are being planned or built in Europe to meet the rising demand for batteries, significantly increasing production capacity. This production is complex, energy-intensive, and relies heavily on advanced IT, often called "Industry 4.0." (an integration of advanced Automation, Internet of Things and Machine learning). In addition, the whole value chain of batteries is also evolving by necessity, with new raw materials and refining operations, equipment suppliers, recycling and testing companies, and so on. Furthermore, there is strong political will that this value chain should be as European as possible, standing on its own legs, and controlled by the European countries and community, preserving European competitiveness, business growth and work opportunities.

In pursuit of climate neutrality by 2050, the European Commission's Vice President has estimated a potential shortage of 800 000 jobs by 2025, spanning the whole value chain.² Many of these jobs are in manufacturing, with approximately 75-80 % of the workforce in a typical gigafactory involved in blue-collar roles³.

² VP Maros Sefcovic has come with this figure at least twice, in a speech 2021 and in a hearing on the Green Deal 2023: <https://www.europarl.europa.eu/news/files/commissioners/maros-sefcovic/en-maros-sefcovic-verbatim-report.pdf> p.34, Last visited 22-05-2024

https://ec.europa.eu/commission/presscorner/detail/en/speech_21_1142 Last visited 22-05-2024

³ Handbook for Training in the Battery Industry, ALBATTs deliverable D6.7 https://www.project-albatts.eu/Media/Publications/97/Publications_97_20240328_95033.pdf p 13 Last visited 22-05-2024

The European battery industry's value chain is still in its infancy, lacking full organization and maturity. Developing training for such a newborn industry, which is not yet fully established in many regions and lacks experienced personnel, has proven challenging. It requires close collaboration among all stakeholders, including industry players, higher education institutions, vocational education and training providers, authorities, social partners, and research entities at the EU, national, and regional levels.

Moreover, external factors such as the COVID-19 pandemic, the conflict in Ukraine leading to fluctuating energy prices and shortages of raw materials, problematic sourcing of raw materials, and political decisions such as the US Biden administration's Inflation Reduction Act (IRA) and recent actual or potential cuts in national and EU battery funding, significantly impact the realization and timing of battery projects in Europe.

Confidentiality within companies is high, with plants still under construction and undergoing adjustments. During this phase, their primary focus is achieving smooth production operations with newly recruited staff. Companies are actively seeking suitable personnel, and the staff turnover is high. Consequently, companies have limited time to collaborate with educational providers to develop public education programs and train teachers for the industry.

Before making investment decisions, it is challenging for education providers to determine whether to initiate training programs, invest in learning facilities, and train their staff for the emerging battery industry. Our experience in the ALBATTTS project shows that teachers and education providers from all over Europe face the same challenges and concerns regarding battery industry training. Many of these challenges will likely prevail for some time.

The battery value chain in Europe and its connected education and training needs will continue to develop rapidly over time. The ALBATTTS project results can be seen as a starting point for departure into the sector's future of education and training.

To form a sustainable, but at the same time flexible, methodological approach to educational design in the battery sector, it is essential to be aware of both internal and external factors affecting change both in the battery sector and within training and education.

The ALBATTs project is a 4.5-year Erasmus+ funded project from 2019-2024, including 21 partners from 11 countries. The partnership comprises VET institutions, higher education institutions, companies, and industry-related associations. The project aims to promote cooperation between all stakeholders in the battery and electromobility value chain to develop a blueprint for education and training for the battery production sector. ALBATTs tackles two main questions:



Figure 1 - ALBATTs' two focus questions

The sector will need to include both young people from initial VET education, adults changing their occupations, and experienced people from other industry sectors that need upskilling and reskilling to apply their skills to a new sector. There is also a need for a highly international workforce since many experts, including operators and technicians, must be recruited from European countries and all over the world. The Northvolt gigafactory in Skellefteå, Northern Sweden, has today about 100 nationalities represented among more than 2 300 production employees.⁴

Other parts of the value chain, other than the emerging cell factories, are changing and need to recruit or upskill/reskill their workforce, for example, in the automotive industry⁵. ALBATTs also worked on this by including partners from the earlier DRIVES blueprint project 2017-2021 and forming the Automotive Skills Alliance, ASA, as a large-scale partnership under the Pact for Skills initiative.

⁴ <https://northvolt.com/articles/northvolt-2022-where-we-stand/> Last visited 12-03-24.

⁵ Handbook for Training in the Battery Industry, ALBATTs deliverable D6.7 https://www.project-albatts.eu/Media/Publications/97/Publications_97_20240328_95033.pdf p 15 Last visited 22-05-2024

List of Abbreviations and definitions⁶

AI	Artificial Intelligence
ALBATTs	Alliance for Batteries, Technology and Skills
AR	Augmented Reality
ASA	Automotive Skills Alliance
BEPA	Batteries European Partnership Association
CLIL	Content- and Language-Integrated Learning
CVET	Continuing Vocational Education
EBA	European Battery Association
EC	European Commission
ESCO	European Skills, Competences, Qualifications and Occupations
EQF	European Qualification System
IVET	Initial Vocational Education
KA1	Key Action 1 - ERASMUS mobility and Internships programme
LMS	Learning Management System
MOOC	Massive Open Online Course
MOU	Memorandum of Understanding
OER	Open Educational Resource
PDCA	Plan-Do-Check-Act (a Lean Six Sigma production concept)
VET	Vocational Education and Training
VR	Virtual Reality
XR	Extended Reality

⁶ For a rich alphabetic list of definitions of EC education terminology and recently often used education-specific concepts used in the ALBATTs project, please consult our deliverable 6.2, Our Education and Training plan, found here https://www.project-albatts.eu/Media/Publications/34/Publications_34_20211201_8120.pdf p 13ff.

1 Methodology

The methodology for this report is quite plain. We conclude our results of the whole ALBATTs project as a blueprint for the sector on the European level. In this, we emphasize what can be especially productive to use and develop further. We also give several recommendations to different target groups based on our results and understanding.

Our work on sectoral intelligence (Work Package 3, 4 and 5), which characterised the first part of the project, ended in month 48 with the third release of our Sectoral Skills strategy⁷. This sectoral intelligence work has been the base for our education and training development (our Work Package 6). We first prepared this education development work by thoroughly checking what was already available as educational materials. We planned how to use the European education policy tools and language to develop education and training when results of the sectoral intelligence showed up, bit by bit. Then, at about month 24, the Education and Training work, WP6, took off in earnest, as there were enough foundations to build it on from the sectoral intelligence. In ALBATTs, we have tried to avoid guessing what the industry needs, which is expected at educational institutions. Education offerings often become based on “what relevant materials can we possibly offer”. With this said, it has been challenging to work in parallel with an emerging industry in Europe that, from the beginning, does not fully know what skills and job roles the sector needs to adapt to a European work environment.

We also present how we have not spared any effort to ensure that the project results will be productive and will be developed further. This battery and electromobility value chain in Europe is still in its infancy, and our work has happened in parallel to its emergence, so more work is obviously needed. There are already several projects and initiatives where this is meant to happen, most of them ERASMUS+ projects.⁸

⁷ https://www.project-albatts.eu/Media/Publications/95/Publications_95_20231212_121521.pdf Last visited 24-05-2024

⁸ See <https://automotive-skills-alliance.eu/strategic-cooperation-of-european-automotive-regions-a-working-agreement-signed-between-the-asa-the-automotive-regions-alliance-and-the-cors-intergroup-for-the-future-of-automotive-industry/> Last visited 24-05-2024

<https://project-key-competence.eu/> Last visited 24-05-2024

<https://project-flamenco.eu/> / Last visited 24-05-2024

<https://project-trireme.eu/> See also ALBATTs coming deliverable deliverable 3.14, Sustainability and Legacy Plan, still not published, but to be found here <https://www.project-albatts.eu/en/results>

1.1 PURPOSE OF THE DOCUMENT

This document aims to highlight the central issues and results of WP6 on education and training for the battery sector. It will give recommendations for the European Commission, national and regional education authorities, education providers and the industry itself on how they can best support education and training and a skilled workforce for the battery industry. It will also discuss sustainability issues of the project results and recommended areas for future development. Recommendations in this document are also mapped to the [Sectoral Skills Strategy for the European Battery Sector](#).

2 Drivers of Change of Education and Training

To make a sustainable but, at the same time, flexible methodological approach to educational design in the battery sector, it is crucial to be aware of both internal and external factors affecting change both in the battery sector and within training and education. We made an ambitious inventory of such factors in our education and training plan, deliverable 6.2⁹. Below, we update and summarise these drivers of change and how our consciousness of them has developed since our training plan was published in 2022.¹⁰ This list of drivers of change is also supported with the findings in the context of skills intelligence coming from the previous development of the project.

ECONOMY AND WORK MARKET

The European employment market is very dependent on the automotive and transportation sectors. Mismatches in the employment market show up, and a flexible training methodology for the learner and the training provider is needed. It should enable reskilling and up-skilling through lifelong learning and easy validation of prior learning. In addition, methods and tools independent of place and time also reach an increasing number of part-time workers. These people may be unable to or may not be entitled to participate in traditional training times or may not be offered training by the employer. Digitally enabled learning, independent of time and place, can be a solution. The Year of Skills, May 2023 to May 2024, where we contributed with material, cases, examples, participation and presence in webinars, etc, made this increasingly evident as a priority.

GLOBALISATION

The battery industry is deeply embedded in a global context, with the world's increasing interconnectivity driving profound implications for Europe's integration within the European Battery Sector in the context of global regulatory dialogue, restructuring of the whole sector or access to raw materials. Cross-border flows of capital, goods, services, people, and ideas, alongside rapid technological advancements, reshape job requirements, creating new opportunities and making some skills obsolete. This dynamic pressures vocational education to swiftly adapt by updating qualification requirements, training programs, and curricula. Europe's impending battery and electromobility transformation will require approximately 3-4 million workers, primarily with VET backgrounds. To enhance labour mobility and integration, Europe must facilitate internal mobility and integrate third-

⁹ See ALBATTs deliverable 6.2, https://www.project-albatts.eu/Media/Publications/34/Publications_34_20211201_8120.pdf Last visited 24-05-2024

¹⁰ Ibid

country nationals. Given the multicultural nature of many gigafactories, emphasizing language and intercultural skills in battery sector training is essential.

Additionally, the development of tools for recognizing and validating prior learning, along with a unified approach to accrediting skills, is crucial¹¹. In 2024, we see that the first homegrown European gigafactory, Northvolt Ett in Skellefteå, Sweden, employs people from more than 100 nationalities, and the company counts more than 120 nationalities¹². Chinese and South Korean companies (CATL, AESC, LG Chem, Samsung, etc.) are starting gigafactories in Europe. They are becoming employers in Europe, and the value chain is still highly globalised. However, Europe has a clear political will to make the European value chain more self-sufficient, robust and possible to control. Perhaps the most significant problems are related to raw materials and equipment manufacturing.

SOCIAL AND DEMOGRAPHIC CHANGE

Europe's population is expected to stabilize or decline by 2050 due to an ageing population, with over-65s projected to reach 30% by 2070¹³. This demographic shift, with low fertility rates and migration, raises concerns about a shortage of working-age adults. By 2070, Europe's share of the global population is forecasted to drop to under 4%. A system for identifying and recognizing prior skills must be developed to address skill needs in the battery sector, accommodating workers from various industries and countries. This is a question of not wasting resources in the form of people's skills, experience and time for education and training. Flexible training courses should cater to individualized pathways, allowing learners to choose when and how to learn, potentially attracting new talent to the sector.

TECHNOLOGICAL CHANGE

Technological advancement, economic globalization, and demographic shifts shape labour demands, often necessitating higher skills rather than merely replacing jobs – such as cybersecurity, standardisation and regulations, smart grids or other new technologies.. VET systems face challenges adapting to rapid technological changes, requiring quick responses to evolving labour market needs. Continuous upskilling and reskilling of adults are crucial in this context, highlighting the importance of a mindset for lifelong learning. Besides technical skills,

¹¹ ALBATTs deliverable 6.2

https://www.project-albatts.eu/Media/Publications/34/Publications_34_20211201_8120.pdf , p10-11

¹² <https://www.framtid.se/arbetsgivare/northvolt-ab> Last visited 24-05-2024

¹³ https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Ageing_Europe_statistics_on_population_developments

non-technical competencies like critical thinking, creativity, and teamwork are essential skills. Industry 4.0 and 5.0 will change jobs in a way that values actual human capacities as transversal skills more than skills that machines and algorithms can assist.

2.1 NEW FACTORS

Since 2020, some new and unforeseen factors have affected the development of education and training offerings in the field of battery technology. These include¹⁴:

- 1) The Covid-19 pandemic 2020-2022 resulted in an increased readiness for more flexible (e.g. including virtual) education, but also temporarily slowed down the development of needed new education and training programmes.
- 2) Volatile energy prices and a problematic raw materials market halted the rollout of planned battery gigafactories. This, in turn, slowed down the start of regional vocational education for these plants. The war in Ukraine resulted in raw material deficiency, as Russia was discarded as a provider. It also disturbed the energy prices and investment decisions.
- 3) The US Biden administration's Inflation Reduction Act (IRA) caused the re-direction of some European battery value-chain investments to the American continent. Education and training development in European regions where investment is cancelled are highly affected.
- 4) Recent actual and potential future cuts in national and EU battery funding may cause uncertainties and slow down or stop educational and training developments in the most critical stage of the transition to a battery economy.

¹⁴ See the Batteries Europe Education Task Force Position paper April 2024 (where ALBATTs has been active in this analysis): <https://batterieseurope.eu/results/position-papers-on-cross-cutting-topics-2024/position-papers-on-cross-cutting-topics/> Last visited 24-05-2024

3 ALBATTs Education and Training Framework

ALBATTs education approach considers the main drivers of change that affect skills needs, education and training, the relevant European frameworks, instruments and tools, and the pros and cons of existing OER and ICT tools.

ALBATTs Education and Training Framework, as proposed in deliverable 6.2, the education and training plan¹⁵, identifies four central pillars that constitute the guiding principles for the battery sector:

- ◆ Pillar 1 – Curricula for all levels
- ◆ Pillar 2 – Innovative and flexible learning
- ◆ Pillar 3 – Competent trainers and tutors
- ◆ Pillar 4 – EU-wide recognition

These pillars are closely connected with sectoral intelligence to guarantee stakeholders' participation and up-to-date information in the system, and quality assurance mechanisms underpin them. EQAVET quality criteria are used to continuously ensure the improvement of the education and training provision, based on the PDCA cycle, supported in strong feedback loops, including peer evaluation, as established by the new recommendations for EQAVET.

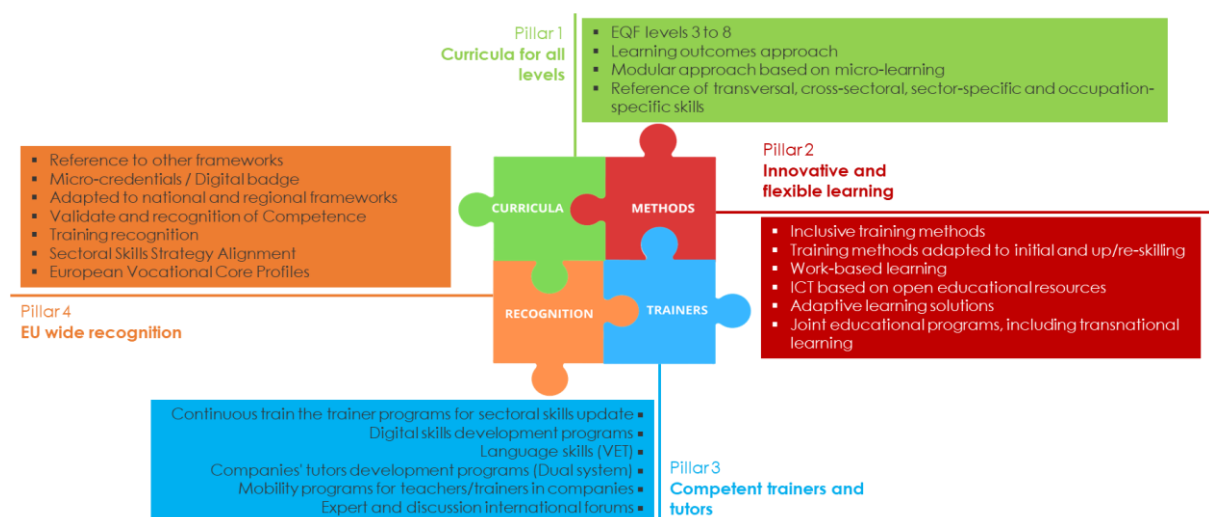


Figure 2 – ALBATTs Education and Training framework

¹⁵ https://www.project-albatts.eu/Media/Publications/34/Publications_34_20211201_8120.pdf Last visited 27-05-2024

4 Actions addressed by ALBATTs

ALBATTs has focused on two overarching questions:

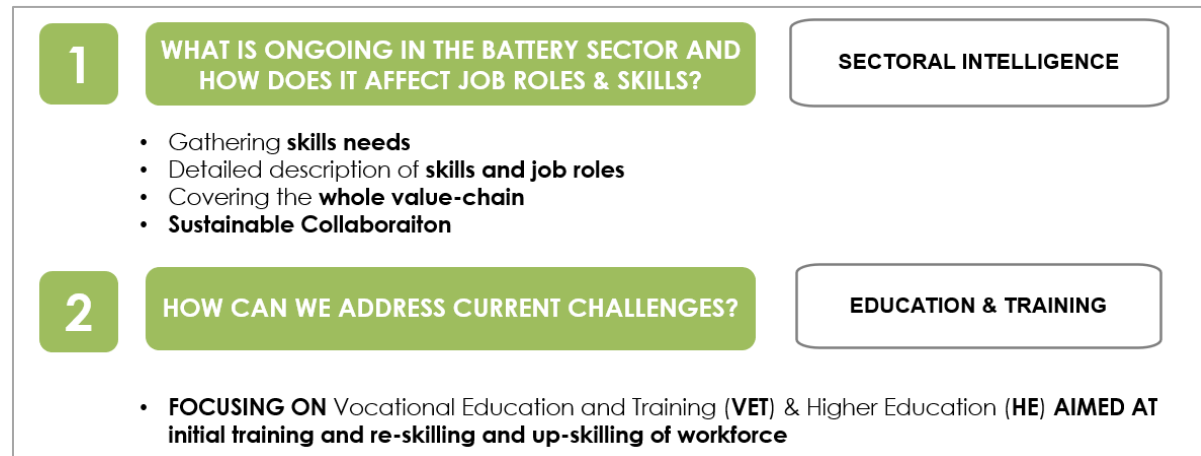


Figure 3 - ALBATTs' two focus questions

During the ALBATTs project, the following actions have been addressed:

1. Sectoral Intelligence work, which identified the job roles and skill needs for the entire battery value chain through desk research, questionnaires, workshops and trend analysis.



Figure 4 - ALBATTs' webinars & workshops

2. Research and report on the existing state-of-the-art of job roles and education and training in the sector were done at the very beginning of the project.



Figure 6 - ALBATTs' reports

3. Besides direct project activities, ALBATTs made broad and ambitious attempts to network with other relevant European projects, initiatives and European organisations. This was to avoid double work and create collaboration and dissemination channels.



Figure 7 – Cooperation with other initiatives

4. An education and training work plan based on desktop research, analysis and a report on priorities chosen for the development of the ALBATTs education and training framework, including i) Drivers of change affecting education and training; ii) State-of-the-art existing frameworks, instruments and tools, iii) other issues to consider when developing education and training and curriculum design, iv) different type of VET education and learners, v) the character of national VET curricula in Europe, vi) Best practices and evaluation of other Erasmus+ Blueprint projects, vii) State-of-the-art of available OER tools and skills.
5. The ALBATTs Education and Training framework with four central pillars: 1) Curricula for all levels, 2) Innovative and flexible learning, 3) Competent trainers and tutors, 4) EU-wide recognition

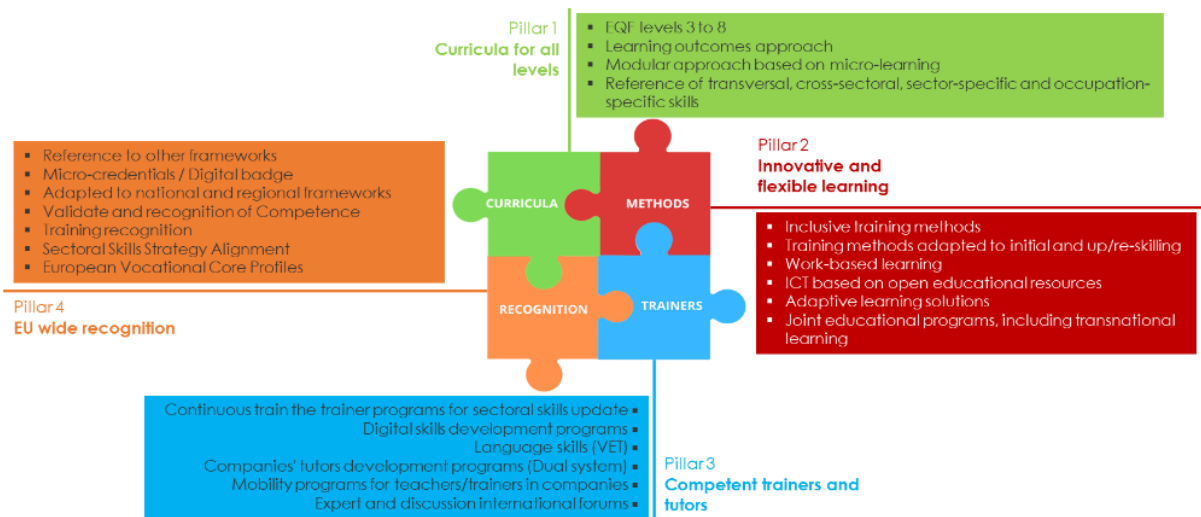


Figure 7 – ALBATTs Education and Training framework

6. The development of Curricula and training modules, based on learning outcomes and some of them built on the micro-learning approaches

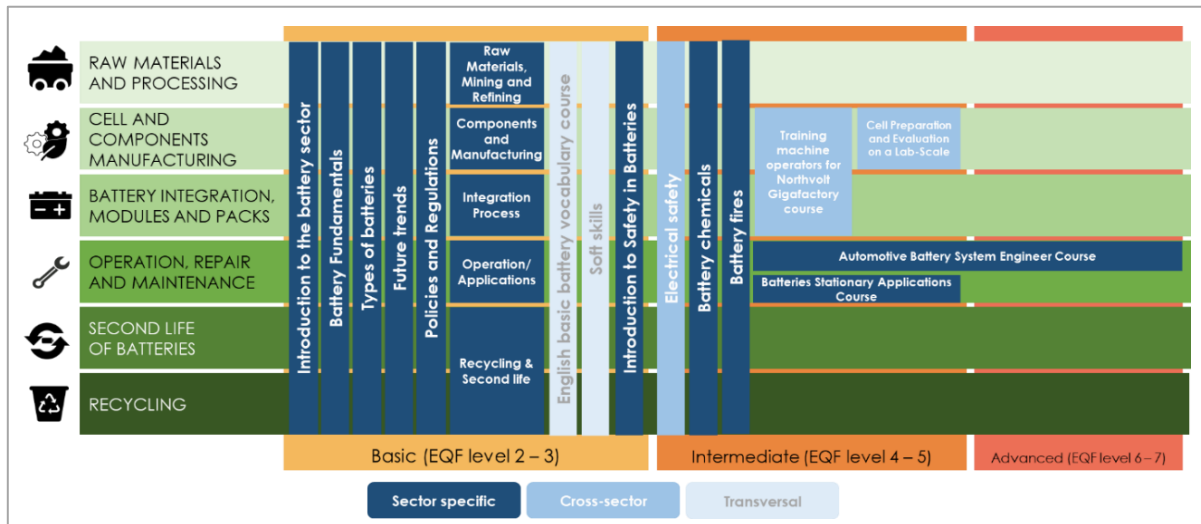


Figure 8 - ALBATTs overview of curricula and training courses

7. National roll-outs of the curricula

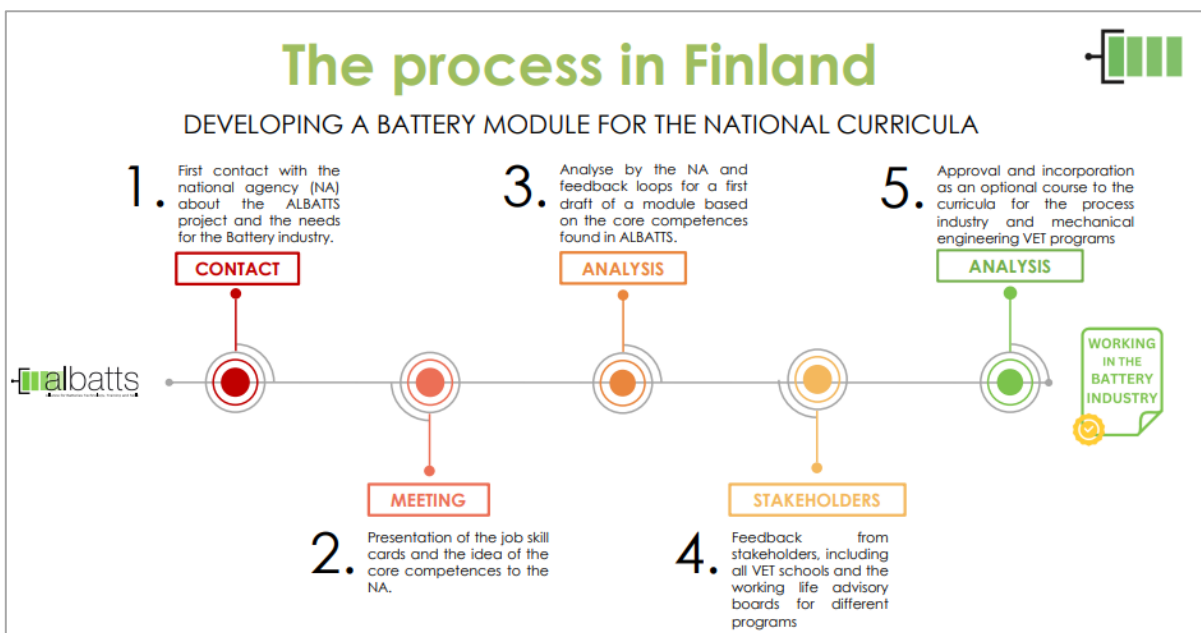


Figure 9 – National Roll-out model

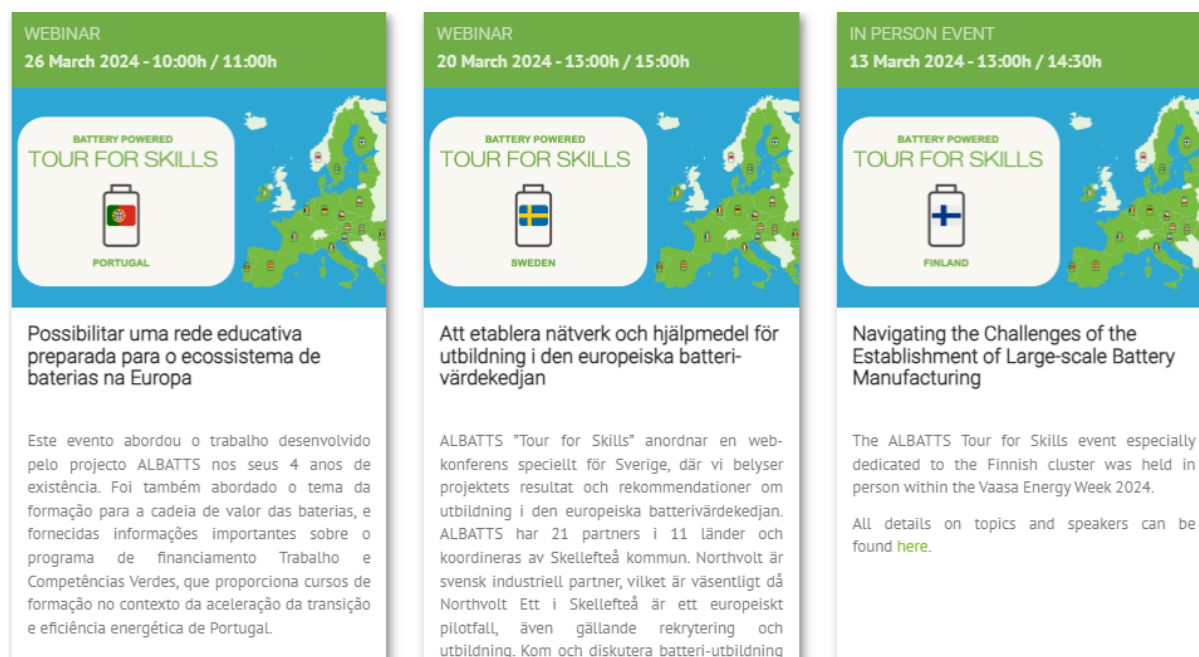


Figure 10 – National Roll-out events in Europe

8. Digital badges for the micro-credentials



Figure 11 – Digital badges

9. On-line courses on the Automotive Skills Alliance platform that can be used for synchronous and asynchronous training in IVET and CVET and for re-skilling and upskilling

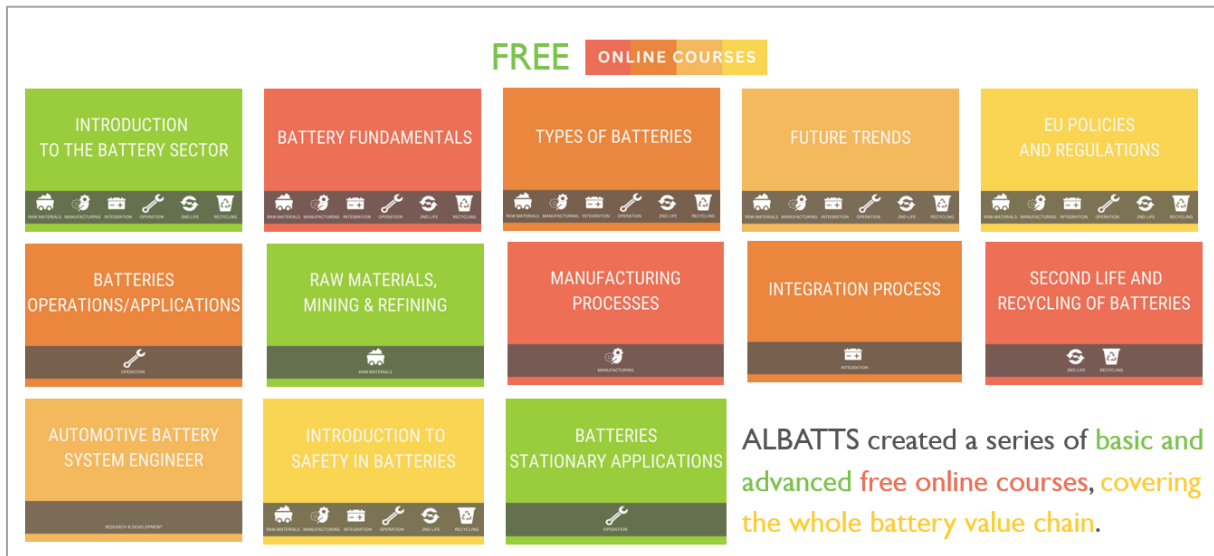


Figure 12 – ALBATTs free online courses

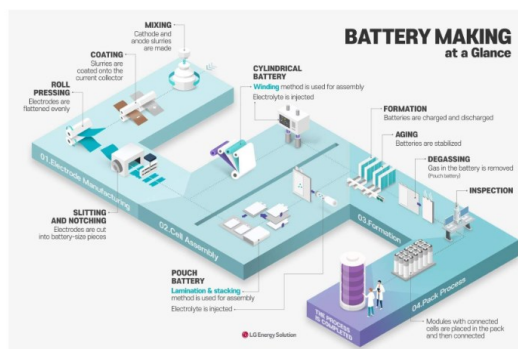
10. Pilot training actions in various countries and settings with different types of learners, including IVET, CVET, HE and working life students.

Match the production step to the right category:



Winding	Preparation of input materials - Upstream production
Ageing	Electrode manufacturing
Coating	Cell assembly
Prepare slurry	Cell finishing

SUBMIT



Within some of the large battery manufacturers, the production department can be divided into two main sections: “**upstream**” production, preparing the input materials. This production section, where chemical processes take place, can be managed from a control room and requires a much lower number of employees

Figure 13 – Piloting Albatts courses

11. A Handbook for training in the battery industry Why?, What?, Where? How?¹⁶




Figure 14 – A Handbook for training in the battery industry

12. Developing, launching and piloting of an international training forum for VET teachers, BATT Forum¹⁷

BATTERIES TEACHERS & TRAINERS FORUM

The **BaTT Forum** is an initiative that was launched by ALBATTs with the purpose of **gathering** current and future teachers and trainers to share **ideas** and **good practices**, **work together** and deepen their **knowledge** about the battery sector.



BATTERIES TEACHERS & TRAINERS
FORUM

The **BaTT Forum** is now funded and further developed through the **CaBatt** - Capacity Building for Battery Teachers in VET, an Erasmus funded project developing a sustainable model for offering Erasmus+ courses for VET teachers.

Figure 15 – Batteries Teachers&Trainers Forum

¹⁶ https://www.project-albatts.eu/Media/Publications/97/Publications_97_20240328_95033.pdf Last visited 27-05-2024

¹⁷ https://www.project-albatts.eu/Media/Publications/97/Publications_97_20240328_95033.pdf p 48-54, Last visited 27-05-2024



Figure 16 – Batteries Teachers&Trainers Forum in Czech Republic May 2023

EU-POLICIES AND PROGRAMS that have been taken into consideration when developing the ALBATTs blueprint:

General:¹⁸

- The EU recovery plan¹⁹
- The European Green Deal²⁰
- The Fit for 55 Climate Package²¹
- CO2 Regulations for cars and vans²²
- The Battery Regulation (part of the Circular Economy Action Plan)²³
- The Net Zero Industry Act²⁴

¹⁸ ALBATTs D 1.7 ALBATTs' Sustainability and Legacy Plan <https://www.project-albatts.eu/en/results>

¹⁹ https://commission.europa.eu/strategy-and-policy/recovery-plan-europe_en Last visited 27-05-2024

²⁰ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en Last visited 27-05-2024

²¹ <https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55/> Last visited 27-05-2024

²² https://climate.ec.europa.eu/eu-action/transport/road-transport-reducing-co2-emissions-vehicles/co2-emission-performance-standards-cars-and-vans_en Last visited 27-05-2024

²³ https://environment.ec.europa.eu/topics/waste-and-recycling/batteries_en Last visited 27-05-2024

²⁴ https://single-market-economy.ec.europa.eu/industry/sustainability/net-zero-industry-act_en Last visited 27-05-2024

Education- and Training:

- The New Skills Agenda 2016²⁵
- The revised New Skills Agenda 2021²⁶
- The Pact for Skills Initiative²⁷
- The EU Digital Education Action Plan²⁸
- The Council Recommendation of 24 November 2020 on vocational education and training (VET) for sustainable competitiveness, social fairness and resilience²⁹ Accessibility regulations³⁰

EUROPEAN FRAMEWORKS AND INSTRUMENTS that have been taken into consideration when developing the blueprint:

- International Standard Classification of Education (ISCED)³¹
- European Qualifications Framework / Europass (EQF)³²
- European Higher Education Area and the Bologna Process (EHEA)³³
- European Association of Institutions in Higher Education (EURASHE)³⁴
- European Credit System for Vocational education and Training (ECVET)³⁵
- European Credit Transfer and Accumulation System (ECTS)³⁶
- The European Quality Assurance in Vocational Education and Training (EQAVET)³⁷
- The 2018 Key competencies framework³⁸
- National Qualifications Framework (NQF)³⁹

²⁵ <https://www.ecsite.eu/activities-and-services/news-and-publications/european-commission-adopts-new-and-comprehensive>

²⁶ <https://www.europarl.europa.eu/legislative-train/theme-promoting-our-european-way-of-life/file-updated-skills-agenda> Last visited 27-05-2024

²⁷ https://pact-for-skills.ec.europa.eu/index_en Last visited 27-05-2024

²⁸ <https://education.ec.europa.eu/focus-topics/digital-education/action-plan> Last visited 27-05-2024

²⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020H1202%2801%29> Last visited 27-05-2024

³⁰ <https://ec.europa.eu/social/main.jsp?catId=1202> Last visited 27-05-2024

³¹ [https://ec.europa.eu/eurostat/statistics-explained/index.php/International_Standard_Classification_of_Education_\(ISCED\)](https://ec.europa.eu/eurostat/statistics-explained/index.php/International_Standard_Classification_of_Education_(ISCED)) Last visited 27-05-2024

³² <https://europass.europa.eu/en/europass-digital-tools/european-qualifications-framework> Last visited 27-05-2024

³³ <https://ehea.info/> Last visited 27-05-2024

³⁴ <https://www.eurashe.eu/> Last visited 27-05-2024

³⁵ <https://www.cedefop.europa.eu/en/projects/european-credit-system-vocational-education-and-training-ecvet> Last visited 27-05-2024

³⁶ <https://education.ec.europa.eu/education-levels/higher-education/inclusive-and-connected-higher-education/european-credit-transfer-and-accumulation-system> Last visited 27-05-2024

³⁷ <https://ec.europa.eu/social/main.jsp?langId=en&catId=1536> Last visited 27-05-2024

³⁸ <https://europass.europa.eu/en/europass-digital-tools/european-qualifications-framework/national-qualifications-frameworks> Last visited 27-05-2024

³⁹ <https://europass.europa.eu/en/europass-digital-tools/european-qualifications-framework/national-qualifications-frameworks> Last visited 27-05-2024

Other relevant factors that have been considered:⁴⁰

- Different types of VET education
- Youth in VET
- Youth in Higher education
- Adult education and training in VET
- Adult education in Higher education
- Apprenticeship learning
- Re-skilling, up-skilling
- Formal, informal, non-formal learning
- Work-based learning
- Transnational learning
- Learning outcomes
- Modules or Units
- Micro-credentials
- Best practices and evaluation of other Blueprints

Chosen considerations concerning available Open educational resources (OERs), skills and tools⁴¹

In our education and Training Plan, first published in the end of 2021, we examined a number of general issues concerning trends in Internet-enabled education that we had to relate to, and how we should do that. We have followed our own recommendations and strategies until the end of the ALBATTs project. For details, consult D6.2.

- Legal issues
- Usefulness issues
- Available relevant OER sources
- Content sources for education adaption
- Relevant MOOC courses
- OER creation tools
- Adaptive learning
- MOOC course creation
- MOOC course wrapping

⁴⁰ https://www.project-albatts.eu/Media/Publications/34/Publications_34_20211201_8120.pdf and https://www.project-albatts.eu/Media/Publications/34/Publications_34_20211201_8120.pdf Last visited 24-05-2024

⁴¹ Detailed descriptions on how ALBATTs have understood these factors is included in D 6.2 https://www.project-albatts.eu/Media/Publications/34/Publications_34_20211201_8120.pdf Last visited 26-05-2024

5 Recommendations

In this chapter, we are presenting recommendations for implementing an education and training framework for the battery sector in Europe, according to the 4 central pillars identified in the project. For each pillar, we present a description of the requirements and a set of recommendations, identifying the specific target group addressed. EQAVET principles were also integrated, with quality assurance recommendations added to the different described central pillars to continuously guarantee the improvement of the education and training provision by adopting the PDCA cycle in all of its phases. We are also mapping the recommendations with the ALBATTs Sectoral Skills Strategy⁴² for a more comprehensive understanding of its connections.

5.1 PILLAR 1 - CURRICULA FOR ALL LEVELS

To provide the battery industry with the workforce and all the skills needed in the industry, it is central to plan the curricula to reflect a shared vision by the relevant stakeholders and include all levels of education.

ALBATTs has defined vital measures to be taken to ensure **flexible and agile** development of **curricula for all levels**, categorized and structured within the following areas:

- 1) **Wide-spanning scope - EQF levels 3 to 8**
- 2) **The learning outcomes approach**
- 3) **Modular approaches and microlearning**
- 4) **Combination of transversal, cross-sectoral, sector-specific and occupation-specific skills**

Wide-spanning scope - EQF levels 3 to 8	
<p>We recommend all relevant stakeholders develop educational programs according to identified existing and emerging skills requirements, covering all relevant EQF levels, ranging from Initial Vocational Education and Training (IVET) at EQF levels 3-4, Continuous Vocational Education and Training (CVET) at EQF level 5, Bachelor-level education at EQF level 6, Masters-level education at EQF level 7, and PhD-level education at EQF level 8. Strong cooperation between different educational levels is advisable in developing training content and learning environments.</p> <p>Rather than creating specific qualifications and programs tailored solely for the battery industry, we recommend devising a variety of modules specifically designed for the sector, encompassing various job roles and tasks, enabling individuals to transition between jobs and acquire new skills as demand evolves. These modules should be flexible enough to be integrated into training programs and qualifications, also serving purposes of up-skilling and re-skilling. This is even more relevant in connection to the ongoing general “Greenovation” of skills.</p>	
Target Groups	EC National Education Authorities Companies Education Providers

⁴² ALBATTs Sectoral Skills Strategy, release 3, can be found at https://www.project-albatts.eu/Media/Publications/95/Publications_95_20231212_121521.pdf

Example Implementation (Best Practice)	<ul style="list-style-type: none"> - Training modules have been collaboratively developed by Vocational Education and Training (VET) and Higher Education (HE) institutions. - These modules aim to enhance English language and digital skills while delivering substantive content. - Instead of creating entire programs, individual modules have been designed to offer flexibility for various purposes. - The courses incorporate references to cross-disciplinary content, including transversal (soft skills), cross-sectoral, sector-specific, and occupation-specific skills. - Quality assurance: ALBATTs curricula were developed, considering the skills and competencies mapped (skill cards) to guarantee alignment with the industry needs.
Sectoral Skills Strategy Mapping	<p>1.4.2 Modular Training</p> <p>1.4.4 Education Requirements</p> <p>1.4.8 Levels of Education</p>

Learning outcomes approach	
<p>We recommend all relevant stakeholders adopt a clear learning outcomes approach when developing learning modules. These learning outcomes articulate what learners are expected to know, understand, or be able to do following the learning experience, encompassing knowledge, skills, and competencies.</p> <p>We recommend a Learning-outcomes-based approach in all education and training design- and planning for the sector, as this will facilitate:</p> <ul style="list-style-type: none"> • Ease of identifying skills acquired, regardless of the method, location, or timing of acquisition, including prior learning. • Emphasis on showcasing acquired knowledge, skills, and competencies rather than focusing solely on what has been studied and for how long. • Tailoring of training content and methods to align with specific learning outcomes. • Recognition of non-formal and informal learning experiences. • Recognition of learning acquired through experiences in companies and abroad. • Utilization of digital badges (micro-credentials) to acknowledge and validate acquired skills and competencies. 	
Target Groups	EC National Education Authorities Companies Education Providers
Example Implementation (Best Practice)	<ul style="list-style-type: none"> - All ALBATTs courses are based on the learning outcomes approach - The electronic badges provided for the ALBATTs courses on the ASA platform are based on learning outcomes
Sectoral Skills Strategy Mapping	<p>1.4.2 Modular Training</p> <p>1.4.4 Education Requirements</p> <p>1.4.9 Certifications and Micro-Credentials</p>

The modular approach and micro-learning

We recommend that training is based on a modular approach or microlearning, where courses are divided into small, manageable modules or units, each focusing on specific topics or skills.

This recommended modular approach offers several benefits:

- Flexibility within the training program, enabling quick replacement or updates of modules to accommodate the rapidly changing industry needs
- Versatility for use across various target groups and professions.
- Seamless integration of new information and updates into existing training materials.
- Simplified recognition of prior learning in a more flexible manner.
- Tailoring training programs to meet the specific needs of learners and the industry
- Provision of individualized pathways, empowering learners to choose when and how to learn.
- Emphasis on short, focused learning sessions that can be easily integrated into busy schedules, particularly beneficial for industries experiencing rapid change, such as the battery industry.
- Facilitation of just-in-time learning, enabling workers to swiftly acquire new knowledge or skills as required on the job.
- Facilitation of individual learning accounts to track and manage learning progress.

Target Groups	EC National Education Authorities Companies Education Providers
Example Implementation (Best Practice)	<p>- All ALBATTTS courses are based on micro-credentials and can easily be updated</p> <p>- The modules can be used in programs for IVET, CVET, companies, youth, adults, reskilling, etc.</p> <p>- A module has been made for the Finnish national curricula that can be used for many different IVET professions, e.g. process workers, laboratory workers, electrical and automation engineers, mechanical engineering</p>
Sectoral Skills Strategy Mapping	<p>1.4.1 Continuous Update</p> <p>1.4.2 Modular Training</p> <p>1.4.10 Learning Accounts</p> <p>1.4.12 Learning Pathways</p>

Combination of transversal, cross-sectoral, sector-specific and occupation-specific skills		
<p>We recommend that training for the battery industry should include a broad set of different kinds of skills. Some specialized skills are needed to perform the job required. Still, others are necessary for a member of the working community. Furthermore, a worker should be able to move between job roles and quickly learn new things vital for re-skilling and up-skilling the workforce. Skills that should be included in battery training are:</p> <ul style="list-style-type: none"> • Transversal skills - also known as transferable skills or soft skills- are valuable abilities and attributes across various fields, industries, and roles. Critical transversal skills for the battery industry are, among others, <i>English language skills, teamworking skills, crosscultural understanding, communication and problem-solving</i> • Cross-sectoral skills - are those competencies that are transferable and applicable across different industries or sectors. Essential cross-sectoral skills for the battery industry include <i>equipment and tool handling, reporting, documentation, operating machines, digital skills, equipment maintenance, material operation and handling, etc.</i> • Sector-specific skills - refer to specialized knowledge and abilities required in the battery industry, such as knowledge about health and safety standards, safety skills, processes, knowledge about the battery industry and raw materials, etc. • Occupation-specific skills - are the abilities and knowledge areas required explicitly for particular jobs or roles. <i>In the battery industry, an operator may have roles such as operating machines, equipment maintenance, trouble shooting, removing defective products, inspecting faulty products, etc.</i> <p>Training for the battery industry should preferably be conducted in English, employing language-integrated learning (CLIL) methodology or other approaches that strongly support the development of English language skills, given the industry's international nature where English is often the working language. The training should also facilitate cross-cultural cooperation.</p>		
Target Groups	EC National Education Authorities Companies Education Providers	
Example Implementation (Best Practice)	<ul style="list-style-type: none"> - ALBATTTS developed training modules on English in the battery industry, supporting both students and teachers with English vocabulary and expressions in the battery industry - ALBATTTS created a course for teachers on how to develop soft skills among students - ALBATTTS created a cross-sectoral course on safety in the battery industry - ALBATTTS developed several sector-specific courses for the battery industry 	
Sectoral Skills Strategy Mapping	<p>1.5.1 Categorization and Classification</p> <p>1.4.11 Languages</p> <p>1.5.5 Reference Provision</p>	

5.2 PILLAR 2 - INNOVATIVE AND FLEXIBLE LEARNING

To provide quality education and training for all the target groups that could work in the battery sector, it is essential to guarantee the most suitable resources for the development of innovative and flexible learning solutions that fit the preferences of the different audiences that will be targeted.

ALBATTs has defined key measures to be taken to assure **innovative and flexible learning**, categorized and structured within the following areas:

- 1) **Individualized training pathways**
- 2) **Inclusive training methods**
- 3) **Training methods adapted to initial and up/re-skilling**
- 4) **Work-based learning (WBL)**
- 5) **Use of Open Educational Resources (OERs)**
- 6) **Adaptive learning solutions**
- 7) **Joint educational programs, including transnational learning**

Individualized training pathways	
<p>We recommend offering learners individualized pathways that flexibly accommodate their prior learning, existing skills, and the specific needs of both learners and companies. This can be achieved through structuring programs based on a modular system, allowing learners to create personalized learning journeys. This will facilitate:</p> <ul style="list-style-type: none"> • Allowing prior learning and skills to be taken into consideration without having to cover overlapping subjects and losing time • Tailoring of training programs to meet the specific needs of learners, whether they are youth, adults, or have specific time and location constraints • Considering skill requirements for a particular company, for example, for apprenticeship students • Provision of individual learning accounts to track and manage learning progress effectively. 	
Target Groups	EC National Education Officials Companies Education Providers
Example Implementation (Best Practice)	<p>- ALBATTs courses follow a modular approach based on micro-learning, giving the flexibility to build individualized training paths according to learners' specific needs and prior learning.</p> <p>- An Adaptive learning course experience was developed by ALBATTs, which as a pilot involves the Realizeit solution to continuously assess the learner's knowledge, allowing users to demonstrate and gain credit for their knowledge through testing without reading material they already understand. Depending on the learner's prior knowledge, this leads to individualized training pathways.</p>
Sectoral Skills Strategy Mapping	<p>1.4.12 Learning Pathways</p> <p>1.4.10 Learning Accounts</p> <p>1.4.7 Training Methods / Re-Up-Skilling Instruments</p>

Inclusive training methods	
<p>We recommend and advocate for inclusive training methods in the design of training programmes within the battery industry. This is crucial as the sector requires attracting all potential workers, and attracting a wide range of learners is essential. The methods should, whenever possible, be tailored to meet the individual needs of various learner groups, including those participating in Initial Vocational Education and Training (IVET) and Continuing Vocational Education and Training (CVET).</p> <p>Additionally, specific target groups such as youth, working adults, the unemployed, individuals requiring re-skilling or upskilling, immigrant workers, individuals transitioning from other sectors, people with disabilities, shift workers, as well as those with weak study, digital, and English language skills, should be taken into consideration. By adopting inclusive training methods, the battery industry can ensure that all learners can access opportunities for skill development and career advancement.</p>	
Target Groups	EC National Education Authorities Companies Education Providers
Example Implementation (Best Practice)	- The courses developed in ALBATTs follow the recommendations above to enable an inclusive education offer. The final inclusive design of education and training is the responsibility of the education or training provider.
Sectoral Skills Strategy Mapping	1.4.7 Training Methods / Re-Up-Skilling Instruments 1.4.11 Languages

Training methods adapted to initial and up/re-skilling
<p>We recommend developing flexible training methods that can be used for both initial training (IVET) and continuous training (CVET) and for re-skilling and up-skilling of people already in the industry or persons transferring from one sector to another.</p> <p>Synchronous learning methods are recommended for:</p> <ul style="list-style-type: none"> • youth doing their initial training • people who have weak or outdated study skills or limited digital and language proficiency • training content that needs hands-on learning and physical equipment and tools • for the development of transversal skills such as teamwork and collaboration • learning at work, internships and apprenticeship studies <p>Asynchronous learning methods are recommended for:</p> <ul style="list-style-type: none"> • Adults with experience from working life who need to apply new knowledge in their professional settings. • Motivated and independent learners who have strong study skills and good digital and language proficiency • Learners with time-related obstacles, allowing them to access course materials and complete assignments when it is suitable for them • Shift workers • Content which does not require hands-on involvement, physical equipment, or specialized tools.

<p>We recommend developing training methods, materials and applications where:</p> <ul style="list-style-type: none"> the content can be used for initial training and up-skilling and re-skilling the content and applications can be used for both Synchronous and Asynchronous learning methods 	
Target Groups	EC National Education Officials Companies Education Providers
Example Implementation (Best Practice)	<p>- ALBATTs developed training content for teachers and trainers to build training material adapted for each target group. Nevertheless, ALBATTs courses are also available as MOOCs. They can be used for initial training, CVET and up-skilling and re-skilling of the workforce.</p> <p>- ALBATTs courses were developed as online asynchronous training, where students can flexibly do their work at different times without the supervision of a teacher. They can, however, also be used for blended learning and flipped classroom models.</p>
Sectoral Skills Strategy Mapping	<p>1.4.5 Interdisciplinary Education</p> <p>1.4.7 Training Methods / Re-Up-Skilling Instruments</p> <p>1.4.11 Languages</p>

Work-based learning (WBL)
<p>Work-based learning is a central part of Vocational education and training, facilitating hands-on learning in real-world work environments with exposure to industry practices and opportunities to apply theoretical knowledge in a practical setting. Work-based learning can take part in various forms, including internships, apprenticeships, on-the-job training and cooperative education programs.</p> <p>However, work-based learning (WBL) is the biggest challenge in an emerging industry like the battery industry. Confidentiality within companies is high, with plants still under construction and undergoing adjustments. During this phase, their primary focus is achieving smooth production operations with newly recruited staff. Consequently, companies have limited time to offer work-based learning opportunities for learners. The situation is, however, thought to be improved when the industry becomes more mature.</p> <p>Work-based learning in an international setting is also challenging as the situation regarding willingness to take on trainees in this sector seems so far to be the very restrictive in all countries.</p> <p>When work-based learning in the industry is not possible, we recommend the following:</p> <ul style="list-style-type: none"> Physical learning labs in VET schools <ul style="list-style-type: none"> It is suggested that facilities and equipment that can be used for several industries, not only the battery industry, be invested in. The investments are costly, and equipment is quickly outdated. It is advisable to invest in equipment from providers that can provide support, update the programmes, and provide training material and online courses. Several companies offer training equipment and materials, such as ABB, Siemens, Festo, etc.

- A model where VET schools, adult education, and higher education establishments invest in facilities together with the local industry is recommended.
- Cooperation with companies providing R&D and training lines is recommended

- **Digital learning environments:**

- **XR /VR/AR** applications are developing fast. They may provide valuable training opportunities before beginning employment if apprenticeship periods are difficult to arrange.
- **Battery factory simulators** and simulators for other industries
- **Personal telepresence**, by use of telepresence robots, is a way to be present in a remote location in a more empowered way
- Different types of **360° immersive learning environments** using AI
- **Factory simulation** is essential for more than just manufacturing optimization; it explores options and enhances communication. For companies using automation, for example, Siemens Digital Industries Software provides an advanced system for battery factory simulation, covering battery modelling, engineering, and consulting services.
- **Remote instrumentation** is the practice of running, using, and manoeuvring physical equipment, machines, or scientific instruments at another location using digital communication. In this way, some lab equipment for learning can be shared between education providers, training institutes and companies.
- A **digital twin** is a virtual replica of a physical object, process, system or environment, creating real-time data and simulations to mimic its physical counterpart. This can allow learners to practice skills in a safe and controlled environment.
- The use of **AI**, to be developed.⁴³

Target Groups	EC National Education Officials Companies Education Providers
Example Implementation (Best Practice)	Within ALBATTs, the VUX adult education centre in Skellefteå, Sweden, developed training for automation operators, maintenance technicians, quality technicians and up-skilling/re-skilling courses for the battery industry. Skellefteå municipality has invested in learning environments and equipment for this training. The training equipment and facilities are also used by higher education and by Northvolt, training their staff in the evening. Examples of physical learning environments at VUX in Skellefteå can be seen in ALBATTs' Handbook for training in the Battery Industry – Why? What? Where? How? ⁴⁴
Sectoral Skills Strategy Mapping	1.4.7 Training Methods / Re-Up-Skilling Instruments

⁴³ See ALBATTs Handbook for Training in the Battery Industry, https://www.project-albatts.eu/Media/Publications/97/Publications_97_20240328_95033.pdf p. 73-79. Last visited 27-05-2024

⁴⁴ https://www.project-albatts.eu/Media/Publications/97/Publications_97_20240328_95033.pdf p. 36ff

Use of Open Educational Resources (OERs)

We recommend promoting, developing and using Open Educational Resources (OER) as training material in the battery sector as much as possible. Learning material made particularly for the battery value chain is not commonly found, but this may change in time. The ASA learning Moodle platform hosts the ALBATTs-produced OERs. Also, it hosts or references other OERs to use, both for individual learners and education providers.

Open Educational Resources (OERs) are beneficial for:

- **Students/learners** – free access to educational materials and additional resources to support their learning, including textbooks, videos, interactive simulations, etc.
- **Trainers and educators are offered a vast repository of teaching materials that they can adapt, remix, and customize to suit the needs of the students and their** instructional goals.
- **Institutions** – educational institutions and companies can offer a broader training scope to students and staff while reducing the time and costs of developing training material. There are many free tools for creating OERs from which to choose. It will also improve flexibility in training times.
- **Life-long learners** - OER cater to individuals of all ages and backgrounds who engage in self-directed learning, acquiring skills outside of formal educational settings
- **Language learners**- OER are available in multiple languages, making them valuable resources for language learners who want to practice reading, listening, writing and speaking skills in their target language.

MOOCs have many flexible uses for individual and group studies, at home and in the workplace. Most MOOCs demand in practice some educational background but are not closed for others. They can be hard to use on a vocational level, as the language is often English, background knowledge and study skills can vary, and there is a lack of social support. MOOCs can also be used in social learning settings and as course materials wrapped within other conventional courses.

Regarding the use of OERs for training in the battery industry, **we recommend the following:**

Legal guidelines should be followed:

- All relevant IPR and copyright regulations should be followed
- The CC license offers a lot of possibilities for adapting and reusing existing learning material. It is recommended for the use of all learning materials produced for the battery industry. The basic CC BY-SA license fits most needs.

Usefulness issues are central when choosing:

- **The accessibility** of the OER should be taken into consideration, including readability, text-to-talk options, language adaptations, etc.
- **Quality issues** – is it reliable information, academically sound and does it fit the level of teaching?
- The fit of an OER into a course from a **pedagogic/didactic** point of view
- What is the **language level used** – does it fit the learner's level?
- **Technical format issues** - if a file format fits into the LMS used and can run on student computers and typical home or mobile bandwidths.

<ul style="list-style-type: none"> • Learning time of the OER – if a module fits into the course concerning reasonable learning time • Granularity of the OER – many OERs are too large. The optimal granularity of an OER should often be smaller – as one concept or problem at a time • Adaptability of the OER - The possibility of using only a part of a learning resource or adapting it in other ways for a better fit. • Learning analytics possibilities - Is there any assessment component attached so the teacher can know if the material has been used or even mastered on a decent level? • “Blending” issues for the OER - How can the OER be integrated into the course structure so that it does not only become extra material? <p>ALBATTs’ work has been aimed at formats for learning material that are open, accessible, adaptable and have a useful granularity and learning time (one concept at a time) for various uses. The produced material should fit most LMSs and adaptive learning solutions. This does not rule out smaller courses and MOOCs. The multi-language question is also critical.</p>	
Target Groups	EC National Education Officials Companies Education Providers
Example Implementation (Best Practice)	<p>- ALBATTs courses are free to use and provided during and after the project by the Automotive Skills Alliance Learning Platform (learn.skills-framework.eu).</p> <p>- ALBATTs developed training content unit documents for teachers, which can be used under the CC BY-SA license and are available in the Automotive Skills Alliance learning platform or through our BATT Forum work, continuing with the CaBatt project.⁴⁵</p>
Sectoral Skills Strategy Mapping	1.5.3 Available Tools and Instruments

Adaptive learning solutions	
<p>Adaptive learning is an intelligent tutor, which personalizes learning, so that all learners can achieve a high level of knowledge. It aims to help each learner achieve the maximum of their ability in the time needed. A truly adaptive learning system is designed with the variability of learner capabilities in mind - it measures learner progress, allows learners to progress ahead where they demonstrate that they already understand concepts, and provides remediation where learners demonstrate deficits in their knowledge. (from D6.2).</p> <p>Adaptive learning is developing now fast with new AI technology. The long-lasting effects will indicate that learning can become more personalized and tailored to an individual's needs and situation without the usual limits of economically viable groups or class sizes, standardised course periods, etc. It can also make excessive testing unnecessary. However, the social aspects of learning must be restructured when adaptive learning is developed further.</p>	
Target Groups	EC National Education Officials Companies Education Providers

⁴⁵ See <https://vamia.fi/sv/projekt/cabatt-capacity-building-for-battery-teachers-in-vocational-education-and-training/> Last visited 27-05-2024

Example Implementation (Best Practice)	<p>- ALBATTs developed an adaptive learning course for Batteries Basics in which learners have the option to start each learning unit by choosing Determine Knowledge (DK), an intelligent optimization feature built into the Realizeit solution. DK intelligently selects questions which have high discernability about a learner's understanding of a knowledge item. The questions are drawn from throughout the learning unit and, where evidence is captured, it is used to provide a form of heat map of knowledge for the learner on their learning journey. Should they be successful, to complete lessons, these will be marked with the level of evidence or ability that the learner has achieved through direct evidence without having to work through all of the learning content. This allows the system to respect the prior knowledge of learners and optimizes learner time by removing the necessity of working through material that they already know.</p>	
Sectoral Skills Strategy Mapping	1.4.7 Training Methods / Re-Up-Skilling Instruments	

Joint educational programs, including transnational learning		
<p>We recommend the development of joint educational programs, including transnational learning. Educational providers in the battery industry should collaborate on learning outcomes, course content, and delivery methods. This collaboration allows for the sharing of expert knowledge and accessibility to various digital applications. Additionally, it promotes co-learning and expertise sharing among teachers, ultimately saving time and resources. These joint programs can be implemented on both national and international levels.</p> <p>On an international scale, joint educational programs facilitate the development of transversal skills such as language learning, cultural cooperation, and teamwork among both learners and teachers. Given the international nature of the battery industry, the diverse nationalities within companies, and English as the primary language of communication, transnational learning is particularly valuable.</p> <p>Transnational learning initiatives can include joint online courses, workshops, projects, and physical activities such as courses, workshops, projects, or internships abroad. These opportunities can be funded through Erasmus+ mobility funding.</p>		
Target Groups	EC National Education Authorities Companies Education Providers	
Example Implementation (Best Practice)	<p>- The ALBATTs training offer was co-created by different educational providers from various countries within the partnership, which included developing the learning outcomes, curricula, and training materials.</p> <p>- Joint educational programs were implemented internationally for teachers and trainers while implementing the Batteries Teachers and Trainers Forum initiative. Besides sectoral-specific skills, these initiatives also facilitated the development of transversal skills such as language learning, cultural cooperation, and teamwork among both teachers. This initiative was partially funded through Erasmus+ mobility funding.</p>	
Sectoral Skills Strategy Mapping	<p>1.4.5 Interdisciplinary Education</p> <p>1.4.7 Training Methods / Re-Up-Skilling Instruments</p>	

5.3 PILLAR 3 - COMPETENT TRAINERS AND TUTORS

To provide quality education and training for the battery sector, it is central to have **competent trainers and tutors**. Project ALBATTs has defined key measures to be taken to develop the capacity of trainers and teachers regarding technical and pedagogical competencies, categorized and structured within the following areas:

- 1) **Continuous train the trainer programs for sectoral skills update**
- 2) **Digital skills development programs**
- 3) **English language skills for VET teachers**
- 4) **Companies' tutor development programs (Dual system)**
- 5) **Mobility programs for teachers/trainers in companies**
- 6) **European discussion forums for teachers and experts**

Continuous train the trainer programs for sectoral skills update	
<p>We recommend developing continuous train-the-trainer programs where teachers and trainers get information on sectoral skill updates (what skills are needed and how the work should be carried out). This can be facilitated by:</p> <ul style="list-style-type: none"> • Relevant MOOC and webinars • The study buddy concept (study circles), where teachers learn from and together with peers • Company training for teachers • Work-based learning in the industry for teachers • International opportunities facilitated with Erasmus+ mobility funding such as: <ul style="list-style-type: none"> - job shadowing - teaching and training activities abroad - participating in international courses and workshops online or in person - developing and delivering joint curricula courses with international peers using each partner's strengths. This promotes co-learning and co-creation. • Specific international training for teachers in the battery industry • On-line Battery forums where teachers and industry representatives can exchange news and knowledge • Providing the possibility to take part in national and international projects for the battery industry 	
Target Groups	EC National Education Officials Companies Education Providers
Example Implementation (Best Practice)	- The Batt Forum, launched by the ALBATTs project and carried on by the CaBatt project ⁴⁶ , provides a concept where teachers and trainers take part in thematic training where they learn together online and meet up for a 3-day physical event arranged together with the industry

⁴⁶ <https://vamia.fi/sv/projekt/cabatt-capacity-building-for-battery-teachers-in-vocational-education-and-training/> Last visited 27-05-2022

	<ul style="list-style-type: none"> - ALBATTs' MOOCs on the ASA learning platform develop some needed skills and among teachers - Webinars with industry experts and training providers were recorded and are available on the ALBATTs home page. - A LinkedIn group for teachers and trainers was created - the Batteries Teachers and Trainers Forum - where teachers can share problems, good practices and news about battery technology, teaching and skills.
Sectoral Skills Strategy Mapping	<p>1.4.14 Competent Trainers and Tutors</p> <p>1.4.7 Training Methods / Re-Up-Skilling Instruments</p>

Digital skills development programs	
<p>We recommend developing digital skills development programs for VET teachers in the battery industry as the industry is highly digitalized and automated and continues to develop further in this direction. The development programs should focus on equipping teachers with the necessary digital competencies relevant to the battery industry, such as data analysis, programming for battery management systems, and familiarity with digital manufacturing technologies. Additionally, teachers should receive training on integrating digital tools and resources into their teaching methods to enhance student learning experiences.</p> <p>Digital skills development can take the form of tailored courses focusing on various digital applications and programs. Alternatively, participation in battery-related courses that require the use of diverse digital tools can also foster teachers' digital skills. Engaging in different projects is another effective way teachers can improve their digital proficiency.</p> <p>National authorities should create specific mechanisms to incentivise education providers to develop digital skills programs for their teachers and trainers.</p>	
Target Groups	EC National Education Authorities Companies Education Providers
Example Implementation (Best Practice)	<ul style="list-style-type: none"> - ALBATTs digital online MOOCs enhance teachers' digital knowledge and skills. - In the BattForum, versatile digital methods have been used to introduce teachers to new techniques and applications, allowing them to experiment with these methods and learn where to access further knowledge and acquire these applications. - ALBATTs' Handbook for training in the Battery Industry – Why? What? Where? How? gives information on how education and training experts can use OER and AI in education.
Sectoral Skills Strategy Mapping	<p>1.3.1 Skills and Workforce Shortage</p> <p>1.4.5 Interdisciplinary Education</p> <p>1.4.7 Training Methods / Re-Up-Skilling Instruments</p> <p>1.5.5 Reference Provision</p>

English language skills for VET teachers		
<p>We recommend using English in education and training when possible and for training teachers. English proficiency is crucial in the battery industry due to its international nature. Therefore, it is recommended that training is partly or entirely conducted in English. However, not all vocational education and training teachers possess strong language skills. Hence, it is advisable to provide teachers with opportunities to enhance their English proficiency. This benefits their comprehension of industry-related information, collaboration with peers from other countries, and development and delivery of battery-related courses in English.</p> <p>To facilitate this, we recommend:</p> <ul style="list-style-type: none"> • Giving teachers resources to develop their English skills and make it part of the annual work-and development plan • Offering battery-related courses with English as the language of instruction for teachers • Developing Content and Language Integrated Learning (CLIL) programs enables teachers to learn both the content and English language simultaneously. • Providing opportunities for teachers to participate in English language courses, whether regionally, online, or through Erasmus+ English courses. • Offering English conversation courses for teachers • Facilitating participation in international webinars, seminars, courses, projects and different teacher forums either online or in person. • Encouraging teachers to collaborate on joint courses with counterparts from other countries. <p>National authorities should create specific mechanisms to incentivise education providers to develop digital skills programs for their teachers and trainers.</p>		
Target Groups	EC National Education Authorities Companies Education Providers	
Example Implementation (Best Practice)	<ul style="list-style-type: none"> - All ALBATTs courses are available in English and will increase the participants' knowledge of English. - ALBATTs has developed basic English battery courses for teachers, covering key terminology, pronunciation, and their meanings in English. These courses can also serve as supplementary materials for sector-specific content courses. - A BaTT Forum concept has been established where teachers participate in online English courses and attend physical training sessions alongside visits to companies and various workshops, promoting discussions in English. - Being involved in an international project such as ALBATTs has boosted teachers' confidence and improved their English skills. This progress is evident in their ability to converse, create learning materials, and deliver presentations effectively in English 	
Sectoral Skills Strategy Mapping	1.4.11 Languages	

Companies' tutors development programs (Dual system)		
<p>We recommend developing programs for tutors and mentors within companies to train new staff and students on internships and apprenticeship programs. It is crucial that they are knowledgeable about the diverse needs of various types of learners, including iVET students, cVET students, youth, adults, and international learners. The demand for company tutor training will increase as the industry matures and becomes more receptive to hosting interns and apprenticeship students.</p>		
Target Groups	EC National Education Officials Companies Education Providers	
Example Implementation (Best Practice)	<p>- The <i>"Handbook for Training in Battery Industry - Why? What? Where? How?"</i>⁴⁷ developed by ALBATTs can be used to develop training for company-based tutors.</p>	
Sectoral Skills Strategy Mapping	<p>1.4.3 Curricula</p> <p>1.4.4 Education Requirements</p> <p>1.4.6 Standardization</p> <p>1.4.14 Competent Trainers and Tutors</p>	

Mobility programs for teachers/trainers in companies		
<p>We recommend developing mobility training programs for teachers and trainers to enhance their hands-on skills and provide valuable insights into industry characteristics and needs. These mobility programs can be either national or international in scope. This can be facilitated by:</p> <ul style="list-style-type: none"> • Strengthening the cooperation between educational institutions and the industry, including by highlighting the industry's significant role in developing skills for VET teachers. • Implementing professional training schemes and programs for teachers as part of their annual work plans. • Providing regional, national, and EU funding for Vocational Education and Training (VET) providers to offer their teachers professional training and work-based learning opportunities at local or national levels. • Providing and using Erasmus+ mobility funding to support activities such as job shadowing, course participation, or involvement in international projects related to the battery industry. 		
Target Groups	EC National Education Officials Companies Education Providers	
Example Implementation (Best Practice)	<p>- Arranging mobility programs for teachers in this industry remains challenging. However, through the BaTT Forum, teachers have had the opportunity to attend company presentations, visit production facilities, and engage in discussions with staff. Additionally, teachers have been able to explore various digital programs and physical learning environments that can be utilized for battery training.</p>	
Sectoral Skills Strategy Mapping	<p>1.1.2 Overall Cooperation</p> <p>1.1.3 Academia/Industry Cooperation</p> <p>1.4.14 Competent Trainers and Tutors</p>	

⁴⁷ https://www.project-albatts.eu/Media/Publications/97/Publications_97_20240328_95033.pdf Last visited 24-05-2024

European discussion forums for teachers and experts		
<p>We recommend establishing and organizing forums for teachers at national and international levels, where they can exchange challenges, share best practices, collaborate in learning, and collectively develop training materials and programs with peers from other countries. These forums can include sessions in cooperation with higher education institutions, industry representatives, and other expert organizations. These types of forums are also recommended at the national level. The forums can be arranged online with some physical meetings.</p>		
Target Groups	EC National Education Authorities Companies Education Providers	
Example Implementation (Best Practice)	<p>- The BaTT Forum concept has been established where teachers attend physical training sessions alongside company visits and various workshops, promoting discussions about the battery industry, technology, skills and training.</p> <p>- The BaTT Forum launched by ALBATTs provides a LinkedIn group where teachers and trainers can share information and discuss issues in the battery industry, technology, skills and training.</p>	
Sectoral Skills Strategy Mapping	<p>1.1.2 Overall Cooperation</p> <p>1.1.3 Academia/Industry Cooperation</p>	

5.4 PILLAR 4 - EU WIDE RECOGNITION

Guaranteeing a wide European formal recognition of competencies acquired in different learning environments and countries is a key challenge for the battery industry. ALBATTs defined key measures to be taken to assure the **EU-wide recognition**, categorized and structured within the following areas:

- 1) **Framework Coherency** - Reference, use and linkage to other frameworks (ESCO, ASA Skills Hub);
- 2) **National and Regional Outreach** - Adaptation to the national and regional frameworks
 - **Training Recognition** - of the developed training material based on the training type at the EU level
 - **Job Roles and Competencies** - recognition of the used competence concepts and job roles on the EU level
 - **European Vocational Core Profiles** – recognition throughout Europe
- 3) **Validation and Recognition of Competence** - on-the-Job Learning validation, validation of prior learning, validation of informal and non-formal learning, Key Competencies, transversal skills and other competence;
 - **Micro-credentials** - Digital badge/s per training unit (the use of micro-credentials);
- 4) **Sectoral Skills Strategy Alignment** – training and education development is coherent with the sectoral skills strategy for the battery sector.

Mapping to ESCO and other Systems	
<p>We recommend that the developed concepts (job roles, competencies, training units, etc.) be coherent, plugged in, and mapped to European frameworks and systems. These concerns:</p> <ul style="list-style-type: none"> • European Skills, Competencies, Qualifications and Occupations (ESCO)⁴⁸; • Automotive Skills Alliance (ASA) Skills Hub and maturity levels⁴⁹ • Blooms Taxonomy (the revised edition 2001)⁵⁰ • European Qualifications Framework (EQF)⁵¹ 	
Target Groups	EC National Education Authorities Companies Education Providers
Example Implementation (Best Practice)	<ul style="list-style-type: none"> - Directly connecting to the ESCO team and discussing the update, filling the templates and finalizing the inputs to update the ESCO database - Directly contacting ASA to get guidance on plugging the concepts into the framework and hub - Use Bloom's taxonomy to define learning outcomes for the training units and to identify maturity levels of the learning outcomes - Use EQF to define the level of the training courses
Sectoral Skills Strategy Mapping	1.5.1 Categorization and Classification 1.5.3 Available Tools and Instruments 1.5.4 Framework Interlinks 1.5.5 Reference Provision

Validation and Recognition of Competence	
<p>We recommend focusing on the recognition and validation of the competencies that the learners achieve. This may be done in the following ways:</p> <ul style="list-style-type: none"> • Curricula with clear learning outcomes for new and central areas of education and training in the sector are proposed – to be used for the assessment and validation of prior learning • Digital badges are integrated to ensure sector recognition as well as proof of prior learning or learning achievement • To have independent assessors • To validate transnational learning by using Europass 	
Target Groups	EC National Education Authorities Companies Education Providers

⁴⁸ https://esco.ec.europa.eu/en/classification/skill_main

⁴⁹ <https://skills-framework.eu/>

⁵⁰ Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. Theory into practice, 41(4), 212-218. Can be found at <https://cmapspublic2.ihmc.us/rid%3D1Q2PTM7HL-26LTFBX-9YN8/Krathwohl%202002.pdf> Last visited 27-05-2024

⁵¹ <https://europass.europa.eu/en/europass-digital-tools/european-qualifications-framework> Last visited 27-05-2024

Example Implementation (Best Practice)	<ul style="list-style-type: none"> - The curricula developed in ALBATTs are based on the learning outcome, which contributes to the modularity and possible assessment of smaller units of the training course - Digital badges are issued per learning outcome for the ALBATTs-developed courses⁵² - Quality assurance: The skill cards were reviewed by different stakeholders, with a special contribution from Innoenergy Skills Institute / EBA Academy. - Quality assurance: Learning outcomes, training curricula and training materials were piloted during the implementation of the project⁵³ and reviewed by Peers during the BaTT Forum activities.
Sectoral Skills Strategy Mapping	<p>1.1.5 Importance of Skills Transition from the Related Sectors</p> <p>1.4.2 Modular Training</p> <p>1.4.9 Certifications and Micro-Credentials</p>

Training Recognition and Concepts (Skills Cards and Competence)	
<p>We recommend the following to achieve higher recognition within the developed courses and concepts and to boost their impact:</p> <ul style="list-style-type: none"> • To develop various types of courses – MOOC courses for widespread mass consumption; adaptive learning for more targeted and efficient learning; and in-person courses which may be given in more depth as well as mobility programs; • To have competent trainers who train the courses and make them recognized in their country/institution; • Connecting and spreading the training among various countries and ongoing projects; • Having the training and concepts plugged in within multiple platforms which are recognized, such as Skills Hub (http://www.skills-framework.eu/) of the Automotive Skills Alliance that provides micro credentials for training recognition; • Discussing the possibility of having the courses and concepts certified by a recognized body, such as TUV SUD⁵⁴, InnoEnergy Skills Institute and others. 	
Target Groups	EC National Education Authorities Companies Education Providers
Example Implementation (Best Practice)	<ul style="list-style-type: none"> - ALBATTs developed MOOC courses as well as adaptive learning courses together with Realizeit. Courses developed by ALBATTs may be given on-site with the ALBATTs teacher/trainer handbook⁵⁵; - Project ALBATTs organised the VET Trainers Battery Forum to train the teachers in the battery sector

⁵² <https://skills-framework.eu/assertion?id=M2xpKzFETGVnbGthZUtnclZVMzJMUT09> Last visited 27-05-2024

⁵³ <https://www.project-albatts.eu/en/results> Last visited 27-05-2024

⁵⁴ <https://www.tuvsud.com/en/resource/certificate-finder>

⁵⁵ https://www.project-albatts.eu/Media/Publications/97/Publications_97_20240328_95033.pdf

	<ul style="list-style-type: none"> - Project ALBATTTS connected to many projects and countries to present and provide training courses to boost their impact and their sustainability by further having them updated and continued by stakeholders; - ALBATTTS courses and concepts are plugged in into the ASA Learning Platform⁵⁶ as well as the ASA Skills Hub⁵⁷; - ALBATTTS Courses are offered, used and recognised by the Automotive Skills Alliance (ASA) and EIT InnoEnergy Skills Institute at the time of writing. - Quality assurance: Learning outcomes, training curricula and training materials were piloted during the implementation of the project⁵⁸ and reviewed by Peers during the BaTT Forum activities.
Sectoral Skills Strategy Mapping	<p>1.4.14 Competent Trainers and Tutors</p> <p>1.4.13 Training Providers</p> <p>1.4.12 Learning Pathways</p> <p>1.4.7 Training Methods / Re-Up-Skilling Instruments</p> <p>1.4.1 Continuous Update</p> <p>1.1.6 Projects and initiatives</p> <p>1.1.3 Academia/Industry Cooperation</p> <p>1.1.2 Overall Cooperation</p>

European vocational core profiles

We recommend European Vocational Core Profiles for the battery industry, which have a standard set of learning outcomes that are becoming part of the formal national curricula for vocational education and training in the European member states. Core profiles would be beneficial, especially for the central cross-sectoral skills required for the industry, and they would facilitate the development of joint vocational education and training curricula, qualifications, and micro-credentials. The core profiles would strongly facilitate the mobility of learners and support the automatic recognition of VET qualifications and outcomes of learning abroad.

The most common competences:

- Teamwork, communication, problem solving/troubleshooting
- Analysis methods
- Reporting and Documentation
- Product testing, data analysis, and quality
- English
- Health and safety
- Engineering and production

⁵⁶ <https://learn.skills-framework.eu/>

⁵⁷ <https://skills-framework.eu/>

⁵⁸ <https://www.project-albatts.eu/en/results>

The profiles would be part of the Europass platform and complemented, where possible, by digital vocational content.		
Target Groups	EC National Education Authorities Companies Education Providers	
Example Implementation (Best Practice)	<ul style="list-style-type: none"> - ALBATTs has courses based on learning outcomes that have been identified as central for the sector-specific skills in the battery industry, such as safety issues, knowledge about the battery industry, material, central processes, etc. - Learning outcomes, training curricula and training materials were piloted during the implementation of the project⁵⁹ and reviewed by Peers during the BaTT Forum activities. - ALBATTs Courses are recognised by the Automotive Skills Alliance (ASA) and EIT InnoEnergy Skills Institute at the time of writing. - A module with skills seen as central sector-specific skills has been developed for the National VET curricula in Finland, “working in the battery industry”, that can be used for different VET qualifications. - Quality assurance: The skill cards were reviewed by different stakeholders, with a special contribution from Innoenergy Skills Institute. 	
Sectoral Skills Strategy Mapping	1.5.5 Reference Provision	

⁵⁹ <https://www.project-albatts.eu/en/results>

6 Summary of recommendations per target group

6.1 EUROPEAN COMMISSION

Recommendations for the European Commission

- ◆ Encourage member state countries to adopt a flexible and modular curricula approach to meet the industry's rapid change.
- ◆ Encourage member state countries to broaden programs with the possibility of cross-disciplinary content.
- ◆ Promote cooperation between vocational education and academic education.
- ◆ Stimulate the speed of change concerning the development of new green education at universities by (for example) incentivizing universities to cooperate on course offerings.
- ◆ Make the development of education and training content a more important part of relevant research calls and grants in the sector.
- ◆ Provide funding for the development and investment in physical and virtual training labs.
- ◆ Incentivise member countries to fund mobility also within nations for students and teachers. As funding is allocated for the European mobility of teachers and students, national and regional mobility is equally significant. It can be as costly as European and international mobility.
- ◆ Promote European vocational core profiles for implementation in national curricula.

6.2 NATIONAL EDUCATION AUTHORITIES

Recommendations for national and/or regional authorities

- ◆ Develop more flexibility in the national curricula work and legislation. This is necessary to be agile and quickly respond to the developing needs of the battery and electromobility industry, and the green skills sector at large.
- ◆ Create national incentives for cooperation between VET schools, between universities (as an exchange of course offerings), and between VET schools and universities.
- ◆ Develop a modular system where the modules and learning outcomes can quickly be changed and updated to respond to the needs of the industry. The smaller the modules are, the easier to update or change them.
- ◆ Develop possibilities for cross-disciplinary studies so that students can get insight into the process industry, electrical engineering, automation and robotics, mechanical engineering, digital skills, etc. The need for skills is vast in the battery industry and reaches over different disciplines.
- ◆ Provide funding for teacher training, including the possibility of doing internships in the industry.

Recommendations for national and/or regional authorities

- ◆ Provide funding for the development of both physical and virtual learning environments.
- ◆ Provide funding mechanisms that encourage educational providers to work together and develop training content and virtual learning environments in a common way.
- ◆ Incorporate the development of key competencies for lifelong learning, soft skills, and digital and English skills in the curricula.
- ◆ Put the needs of the battery and electromobility value chain in the context of all needed green skills in the context of EC and global climate action.
- ◆ Allocate funding for domestic mobilities of teachers and students, as regional mobility is equally significant and can be as costly as international mobility.
- ◆ The development of AI learning resources for schools, vocational education and training (VET) organizations, and other training providers should be supported.

6.3 EDUCATION PROVIDERS

Recommendations for VET schools, professional education providers and their teachers

- ◆ Be proactive! No one will develop your education strategy and offerings - you will most likely do that yourself.
- ◆ Form a close cooperation with the company or companies as early as possible – they may help with training content material, learning environments, internships for teachers and students, etc.
- ◆ Stay constantly in contact with the national and regional educational authorities and inform them of the needs of curricula development, cross-disciplinary perspectives, etc. This can also be done in cooperation with the companies. The national authorities will not know what changes are needed in the curricula if no one tells them.
- ◆ Cooperate with higher education establishments both on subject knowledge and possible learning environments. You can find many synergies in developing knowledge and skills, developing training material, learning environments and sharing costs.
- ◆ Study the ALBATTs job Skills Cards and upcoming job advertisements for the battery industry in parallel. It gives a picture of the job roles and the skills needed in the industry.
- ◆ Watch online webinars with many experts provided by the ALBATTs project <https://www.project-albatts.eu/en/listnewsevents> and the vast amount of YouTube clips on the industry available. In addition, you will find much information in the ALBATTs reports.
- ◆ Use the ALBATTs basic courses to learn the industry's basics. If you struggle with English, you can use the provided English courses as support.
- ◆ To deepen your knowledge, study some MOOC courses or take part in more advanced courses. Form study circles among teachers in your school or within your networks. It becomes much easier and more fun to learn! All have previous relevant experiences to link

Recommendations for VET schools, professional education providers and their teachers

to this new area of education and training, and discussing questions, problems, and possibilities with peers is interesting.

- ◆ Get involved and offer ERASMUS mobilities and internships (KA1) abroad for your teachers and students. This is a great way to acquire new knowledge and to network.
- ◆ Get involved in national and international development projects for VET schools for the battery industry, and get teachers involved in these projects. It will develop their content knowledge, digital skills, and English skills, and enlarge their networks.
- ◆ Develop digital skills in your organisation to develop different learning environments using the latest technology.
- ◆ Explore and learn how AI can be utilised in both content development and learning environments.
- ◆ Incorporate training methods that also strengthen the students' soft skills, digital skills, English skills, and skills to function in multicultural working environments.

Recommendations for universities and university colleges

- ◆ Review the programmes presently offered, especially engineering programs, to see how they can be adapted to the needs of the battery and electromobility sector and the wider green skills sector in your region or country. A first adaption can offer optional orientation courses, exam work subjects, etc., adapted to future needs.
- ◆ Cooperate with universities actively researching batteries and electromobility if you do not presently have those disciplines represented at your university. Subcontract another university to run a needed course or two while local research, thereby teaching competence, is built up.
- ◆ Use the possibility to “wrap” a relevant MOOC course on batteries. You can do seminars, labs, and examinations locally, but you must use the teaching and material from the MOOC course. Contact with the MOOC platform is recommended, as this is still a non-regulated area.
- ◆ Cooperate with relevant regional and national industries to discuss and access exam work opportunities and internships.
- ◆ Cooperate with regional industry and relevant VET schools concerning labs, pilot plant access, and co-teaching possibilities.
- ◆ Examine the possibilities for your country concerning access to EC-funded relevant research labs (EC recommends these to be open for education and training needs).
- ◆ Participate in relevant EC R&D projects and look for the education development possibilities for such tasks. Check also up on opportunities to network and fund with ERASMUS+ calls and the Pact for Skills initiative.

Recommendations for universities and university colleges

- ◆ Discuss if your university should join Batteries Europe, Batteries European Partnership Association (BEPA), European Battery Association (EBA) or other EU-wide initiatives for research and education development on the European cooperation level.
- ◆ Be innovative and radical and speed up the development of needed education offerings! The present situation of urgently needed climate action demands an unconventional speed of decision-making, including in higher education.

6.4 COMPANIES

Recommendations for companies

- ◆ Communicate and cooperate with the education providers and involve them in the early stage of a battery cell plant or related industry project.
- ◆ Help the training providers by providing authentic training material and content, learning project materials and similar.
- ◆ If the company has a pilot plant, digital twin, and/or training unit, let public education teachers take part in training and experience learning in a more natural and realistic environment.
- ◆ Offer teachers and more advanced students the possibility of on-site experience through company visits and internships.
- ◆ If needed, to let teachers into a plant with IPR issues, write a customised NDA (non-disclosure agreement) if necessary, rather than not letting teachers in.
- ◆ Coordinate the scope of available public education with your onboarding programmes for newly employed staff and your in-house training for the best total results.

7 ALBATTs Sustainability plan

The ALBATTs deliverable 1.7 is ALBATTs general Sustainability and Legacy plan.⁶⁰ This document describes the following eight sustainability items in more detail. The work done in ALBATTs and the ALBATTs results will be still available after the project and marketed to the relevant stakeholders. In addition, the results will be developed further by different stakeholders, as the Automotive Skills Alliance (ASA), which was formed in part by initiative of ALBATTs. There are also some already funded projects that builds in ALBATTs results to some extent, and there is also project applications ongoing. Please consult this document for detailed status and planning for each of these sustainability items:

ALBATTs Sustainability Item/s
General
Collaboration on Battery and Automotive-mobility Skills Agenda (Stakeholder Network)
Skills Intelligence
Sectoral Skills Intelligence and Strategy (Reports and Data)
Skills Cards and Concepts
Webinars and Workshops
Education and Training
Training Courses
Education and Training Framework
Training and Teachers Forum
Dissemination
Website/ LinkedIn

⁶⁰ The ALBATTs Sustainability and Legacy Plan, Deliverable 1.7, can be found here: <https://www.project-albatts.eu/en/results> It will be published in parallel to this deliverable, 6.8.

8 Areas for development

Several issues remained unexplored and undeveloped in this project due to the emerging nature of the industry, with only a few battery companies operational. Additionally, confidentiality constraints within these companies and the cancellation, suspension, or delay of several major battery projects, along with pending final investment decisions, further limited exploration. Once more companies are established and the industry matures, **the following issues should be addressed:**

- Development of both national and international mobility and internship programs for teachers and students.
- Establishment of companies' tutors/mentors development programs (Dual system).
- Development of apprenticeship training for the battery industry together with the industry when the industry has become more mature and is willing to take on apprenticeship learners.
- Exploration and development of virtual learning environments for hands-on training.
- Creation of joint curricula/educational courses between different education providers to leverage the strengths of various stakeholders and encourage co-learning and co-creation among teachers.
- Expansion of courses for CVET (Continuing Vocational Education and Training) at technician level.
- Development of specialized sector-specific courses on quality inspection of products and troubleshooting, as well as calibration.
- Development of specialised courses for workers in Industry 4.0 and 5.0 environments. This has been asked for but has not been within ALBATTs' work plan nor partnership competencies to work with at a larger scale. It is also a general cross-disciplinary question, which should have its own blueprints.
- Development of large-scale solutions for training, to use when the battery value chain takes off in a more massive scale
- Everything with new affordances provided by AI technology.

9 Conclusions

The ALBATTs project has been a challenging adventure. Still, we believe we have made valuable progress in developing a helpful European blueprint for continued work with education for the battery and electromobility sector in EU members and associated countries.

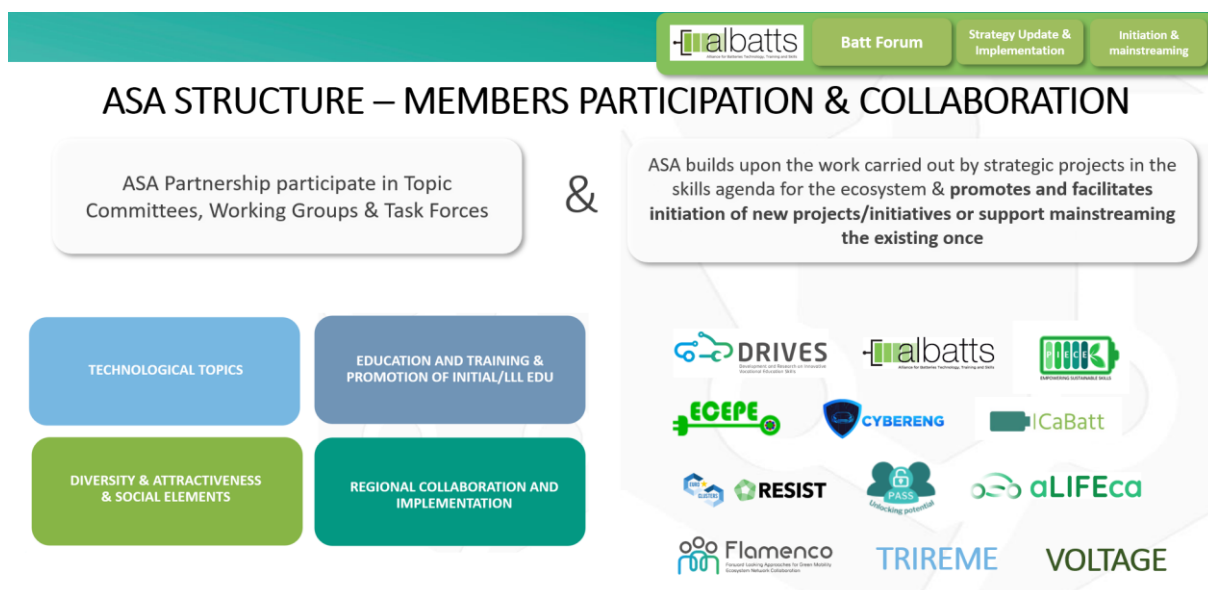
The first sign of this is appreciative feedback from national or regional education development projects in Czechia, France, Germany, Spain, Norway, Sweden, Finland, etc. They seem to use our sectoral intelligence well and are inspired by our sectoral skills strategy. They value the skills cards as instruments to confront their national industries for discussion, and they use and adapt our training material and sometimes translate parts of it. They also seem to get ideas for new national and European projects to develop some part or perspective of ALBATTs work – or for all the angles we have been unable to focus on.

Furthermore, different constellations of ALBATTs' partners are now initiating, leading, or being involved in, many related projects for further development. See a few of them in the graphic below.

One beneficial and sustainable outcome is the Automotive Skills Alliance, a Pact-for-Skills large-scale partnership that DRIVES and ALBATTs project formed with industry representatives. The ASA has since 2022 been a legal entity in Belgium, an ASBL. ASA's membership in Batteries European Partnership Association (BEPA) is also vital, as ASA's close cooperation, supported by a signed MoU, with InnoEnergy Skills Institute (formerly EBA Academy). The ASA has strong regional dimension as well, represented by its Regional members and regional working group. This is further strengthened by Working Agreement on a Strategic Partnership for a Just and Sustainable Transition of European Automotive Regions among ASA & Automotive Regions Alliance⁶¹ & CoRAI⁶².

⁶¹ The Automotive Regions Alliance is a political network of regions committed to the successful transition of the European automotive and supply industry. See more at: <https://cor.europa.eu/en/engage/pages/automotive-regions-alliance.aspx>

⁶² CoRAI – Committee of the Regions - Automotive Intergroup. See more at: <https://www.smr.sachsen.de/en/automotive.html>



At the final ALBATTTS conference in Brussels, April 9th 2024, the representative for DG EMPLOY, the Policy Officer **Mr Felix Rohn**, concluded the ALBATTTS project's impact. Mr Felix Rohn has been following ALBATTTS through the project. We in the ALBATTTS project are happy for this positive summary evaluation:

"I am an official of the European Commission, and as the contact person for ERASMUS+ Blueprint Alliances, I follow these actions. There are now 20 ongoing Blueprint Alliances, and ALBATTTS is one of them. I think you deserve some expression of acknowledgement for the work you did.

Congratulations on your Sector Skills strategy, which is filled with life! It contains the general actions that need to be followed to boost training and education in the battery sector. You have identified skills that workers from other sectors can transfer to the battery value chain. That's also a strand you can follow to hire people. You have identified 26 new emerging occupation profiles, jobs that did not exist recently, four of which are already in ESCO, the European database for occupations and skills. And then you have also, as with every blueprint alliance, developed concrete training content that is already available.

I want to mention the European Battery Alliance Academy in this context. You have an outward-looking approach in the ALBATTTS project, which has been valuable. You have successfully cooperated with the DRIVES project and had the idea to bring InnoEnergy on board. I mention

this because it led to synergies that significantly impacted EU industrial and EU skills policy at the European level.

Stakeholders work along value chains. SMEs are often supply companies or producers that make the final product. They also work on implementing strategies to address the skills gap. The quality of trainings is also good for the supply chain. As they need to deliver high-quality products also suppliers must have good people. And this model – cooperation along the value chain also for training – became the inspiration for the Pact for Skills. The pioneering work of ALBATTs inspired EIT InnoEnergy to propose the European Battery Alliance Academy. This is another impact at the European level, and this Battery Academy is now in place and is delivering, based on results from ALBATTs and in cooperation with ALBATTs. The European Battery Academy has been the model for the Net Zero Industry Academies and the Net Zero Industry Act proposes academies in solar, hydrogen and wind. So, you see, these little grains of DRIVES and ALBATTs have grown into a big plant.

Today, all Blueprint Alliances work with the large-scale partnerships under the Pact for Skills. This is a win-win situation. All 20 large-scale skills partnerships we have, cooperate with, or are even established by, blueprint alliances. This is a win-win situation because they can base their work, as new skills partnerships under the Pact, directly on results that are already available, developed by the ERASMUS+ blueprints. The Blueprint Alliances on their side have a broad audience to spread their results and take care that these results find their applications. So I congratulate you – and keep up the good work!”⁶³

⁶³ The video from ALBATTs final conference can be found here <https://www.youtube.com/watch?v=VupIL-OUFMY> and Mr Rohn’s speech can be found in the very end of the recording. Last visited 24-05-2024 The speech was first transcribed and then processed into written text in collaboration with Mr Rohn, who also made minor adjustments.