SHAPING ADULT TRAINERS' QUALIFICATIONS AND COMPETENCIES IN THE TWIN TRANSITION: A STRATEGIC FRAMEWORK FOR 2050

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Abstract. *By 2050, traditional workforce skills will be insufficient to meet the demands of an evolving labour market where industries are shaped by artificial intelligence (AI), automation, renewable energy integration, and sustainability-driven business practices. The aim of this work is to explore qualifications, skills, and pedagogical approaches required by adult trainers for lifelong learning in the shifting landscape underpinning the elaboration of a strategic framework for 2050. The mixed-method methodology integrates qualitative stakeholder interviews with workforce forecasting and policy analysis. In total, 50 respondents were interviewed in Denmark, Greenland, Iceland, Latvia, Lithuania – five Nordic/Baltic countries. The theoretical and empirical analysis allow concluding that by 2050, competent performance, digital literacy and sustainability expertise will be fundamental in workforce training. The present work carried out within the SMART MAP project highlights the critical role of adult trainers in facilitating the Twin Transition. The interview results show that technical, cognitive, and socio-emotional skills will shape the competence framework for adult education in 2050. This study reveals the necessity for cross-border collaboration in developing strategic frameworks on adult education 2050. Directions of further research have been proposed.*
Keywords: *adult education, adult trainers, Baltic countries, competencies, Nordic countries, qualifications, twin transition.*

Introduction

By 2050, traditional workforce skills will be insufficient to meet the demands of an evolving labour market where industries are shaped by artificial intelligence (AI), automation, renewable energy integration, and sustainability-driven business practices.

Adaptability and effectiveness of adult trainers is ensured by a response to emerging challenges in workforce transformation. The need for adult trainers to develop competencies integrating digital literacy and sustainability awareness becomes urgent. Therefore, the redefinition of adult education to be aligned with the Twin Transition - the combined shift towards a digital and green economy – is required.

The aim of this work is to explore qualifications, skills, and pedagogical approaches required by adult trainers for lifelong learning in the shifting landscape underpinning the elaboration of a strategic framework for 2050.

The mixed-method methodology integrates qualitative stakeholder interviews with workforce forecasting and policy analysis. Content analysis is applied for data analysis and interpretation. Interpretation is revealed by comparison and synthesis carried out by the authors (Ahrens, Purvinis, Zaščerinska, Micevičienė, & Tautkus, 2018).

Literature Review

The Twin Transition highlights the role of workforce reskilling in ensuring economic resilience and social inclusivity (European Commission, 2022). The unity of economic resilience and social inclusivity emphasized the significance of sustainability values to be embedded into adult education (Ahrens et. al., 2024).

The shift towards a green and digital economy demands a fundamental transformation in adult educators' qualification. The key feature of the adult educators' qualification changes

- from the adult educators' subject matter knowledge, when an educator is an expert in a subject (language, mathematics, etc),
- to the adult educator's interoperability, also known as adult educators' competence to work together with learners and other subject educators in order to achieve a shared educational goal.

The competency-based education (CBE) model serves as a foundational framework for these transformations. Competency-based education emphasises skill-based learning pathways that align with workforce demands. However, while the European Qualifications Framework (EQF) (EU, 2008) provides a structured approach, it does not fully account for the rapid emergence of AI-driven learning or sustainability literacy (Schleicher, 2023). The frameworks of DigComp (Digital Competence Framework) (Vuorikari, Kluzer, & Punie, 2022) and GreenComp (European Green Competence Framework (Bianchi, Pisiotis, & Giraldez, 2022) attempt to bridge these gaps, but they remain under-utilised in adult education.

Moreover, AI integration in education raises complex ethical concerns, including algorithmic bias, data privacy, and digital equity (Bäckelin, 2024). While AI-driven adaptive learning can enhance personalisation, the reliance on machine-learning algorithms may create disparities in access to quality education, particularly in underserved regions. Additionally, the environmental sustainability of digital tools remains underexplored—large-scale AI deployment consumes significant energy resources, leading to concerns about the carbon footprint of EdTech solutions.

It should be noted that by a framework the specific viewpoint is meant (Ahrens & Zaščerinska, 2014).

Therefore, the theoretical analysis allows finding that the framework on adult education for 2050 is built on competency approach, adult education digitalisation, and sustainability values. Sustainability values guide the adult education, competency approach serves as the basis of the adult education process, and digitalisation is the means of the educational process.

Methodology

This study employs a mixed-methods approach, integrating qualitative stakeholder interviews with workforce forecasting and policy analysis. The research focuses on five Nordic-Baltic countries: Denmark, Greenland, Iceland, Latvia, Lithuania. Each country represents different stages of digital and green transition adaptation. The countries' selection is based on their participation in the project "Mapping Adult Trainers' Qualifications and Competencies in Twin Transition to SMART future /SMART MAP" supported by the Nordplus programme.

This study uses the European Skills Agenda (European Commission, 2022) and the Green Skills Model (OECD, 2023) to ensure robust competency mapping. The mapping process

involved analysing policy documents, adult educators' interviews, expert interviews, and comparing national qualification frameworks with international standards. The mapping method allowed formulating questions for the semi-structured interviews. The semi-structed interview included

• The questions about socio-economic status of the interviewee, e.g. age group, gender, and field of business.

• The questions about business in future, e.g. image of business in 2050, and qualifications and competences in future (Adaptability and Resilience, Digital Literacy, Complex Problem-Solving, Emotional Intelligence, Creativity and Innovation, Cultural Competency, Data Literacy, Entrepreneurial Mindset, Environmental and Sustainability Awareness, Continuous learning).

• The questions about adult education in future, e.g. image of adult education in 2050, adult trainer qualifications and competencies in 2050.

• The questions about the most important training methods in future, e.g. remote learning, Virtual Reality (VR) and Augmented Reality (AR), gamification, microlearning, adaptive learning, artificial intelligence in training, and collaborative learning.

The questions of the semi-structured interview were translated into the languages of the participating countries (Denmark, Greenland, Iceland, Latvia, Lithuania).

In the semi-structured interviews of the present empirical study, 10 respondents who represented adult trainers from each country (Denmark, Greenland, Iceland, Latvia, Lithuania) - in total 50 respondents - took part. It should be noted that the Nordplus programme considers that Greenland acts as independent country in Nordplus (Nordplus, 2025). The option for these five countries – Denmark, Greenland, Iceland, Latvia, Lithuania - is related to their participation in the project "Mapping Adult Trainers' Qualifications and Competencies in Twin Transition to SMART future / SMART MAP" supported by Nordplus Adult 2023. The two-year project was started on 1st August 2023. The project was developed to create the Map Report on the analysis of adult trainers' emerging qualifications and competencies in twin transition to SMART Future for the increase of adult trainers' employability, economic and social inclusion, and overall social sustainability.

In total, 50 respondents were interviewed in Denmark, Greenland, Iceland, Latvia, Lithuania – five Nordic/Baltic countries. The respondents from Denmark, Greenland, and Iceland represented the views of the Northern Europe, while the respondents from Latvia and Lithuania – the opinions of the Eastern Europe. The countries' division is emphasized for a comparative analysis of the interview results.

50 respondents were selected in the process of information-oriented sampling (Flyvbjerg, 2006). It means that respondents who obtain and could disclose the information relevant to Adult Education 2050 were chosen. The sampling process was based on the principles of sample appropriateness, sufficiency, and confidence (Ahrens & Zaščerinska, 2015). The sample size – 10 respondents for each participating country - was determined by two factors:

• In the data processing phase, the collected data allow extracting the required information in an appropriate form such as diagrams, reports, or tables (Ahrens & Zaščerinska, 2014);

• In the analysis phase, sample's further components or elements do not change conclusions or generalisations drawn from the obtained data (Kroplijs & Raščevska, 2004).

After having collected the answers in the languages of the participating countries in the semi-structured interviews, the respondents' replies were translated into English for the data processing.

On the basis of semi-structured interviews, case studies in Denmark, Greenland, Iceland, Latvia, Lithuania were carried out as well.

Results

Emerging Competencies for Adult Trainers in 2050

The transition to an AI-powered and sustainability-driven economy redefines the role of adult trainers. Interviews' findings indicate that trainers will require technical, cognitive, and socio-emotional skills to support future learners.

It is worth noting that technical skills are in TOP 10 skills essential in contemporary and future employment (Bhati & Zascerinska, 2025). Diverse technical skills in almost every scientific field and industry, from IT and business administration to health care and education are on a high demand (Coursera staff, 2024). By technical skills, specialized knowledge and expertise required to perform specific tasks and use specific tools and programs in real-world situations are meant (Coursera staff, 2024).

In adult education in 2050 emotions will play the crucial role as emotions are primary in comparison to cognition (Ahrens et.al, 2023). In education, emotional skills are often linked with cognitive skills and social (communication) skills (Ahrens et.al, 2023). The combination of emotional, social and cognitive skills in education is important for learner's development (Ahrens et.al, 2023).

Figure 1 reflects key competencies identified across all countries:
- Denmark: Strong focus on AI in vocational education,
- Latvia: Government-driven digital literacy initiatives,
- Lithuania: Growing emphasis on sustainability training,
- Greenland: Limited but increasing tech-based learning adoption,
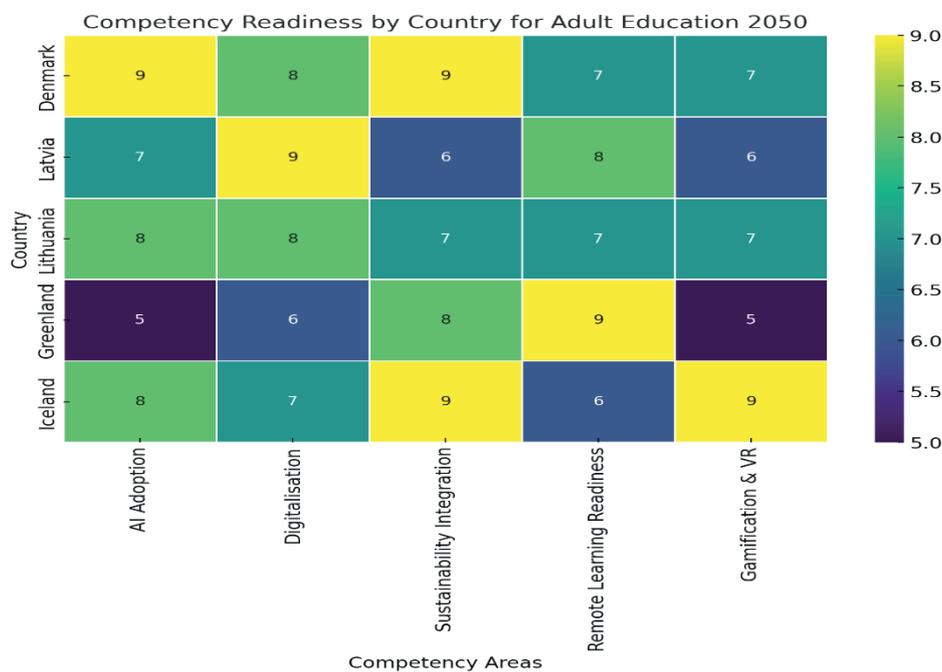- Iceland: Progressive gamification & blended learning models.

Figure 1 **Competency readiness heatmap across countries** *(the author Anna Högnadóttir with use of OpenAI, 2023)*

Future Workforce Trends and Training Needs

The study confirms a paradigm shift in workforce demands, with traditional job roles declining while automation, AI, and sustainability-focused jobs expanding. Analysis of ILO (2022), OECD (2023), UNESCO (2023), WEF (2023), CEDEFOP (2022), and European

Training Foundation (2023) allows finding that workforce readiness by 2050 will require adult trainers to bridge the skills gap in AI and green technologies as shown in Figure 2.
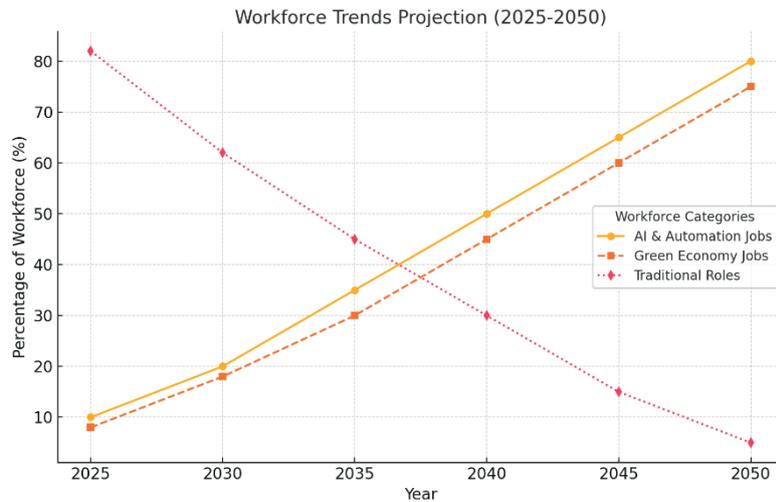

*Figure 2 **Workforce trends projection (2025-2050)** (the author Anna Högnadóttir with use of OpenAI, 2023)*

Innovations in Training Methods for Adult Learning

Interviews' findings indicate that the future of adult education will be heavily technology-driven, flexible, and gamified.

Figure 3 demonstrates the most effective training models identified across the five case study countries:

- Denmark & Iceland: AI-driven adaptive learning and VR-enhanced training,
- Latvia & Lithuania: Micro-learning and hybrid learning,
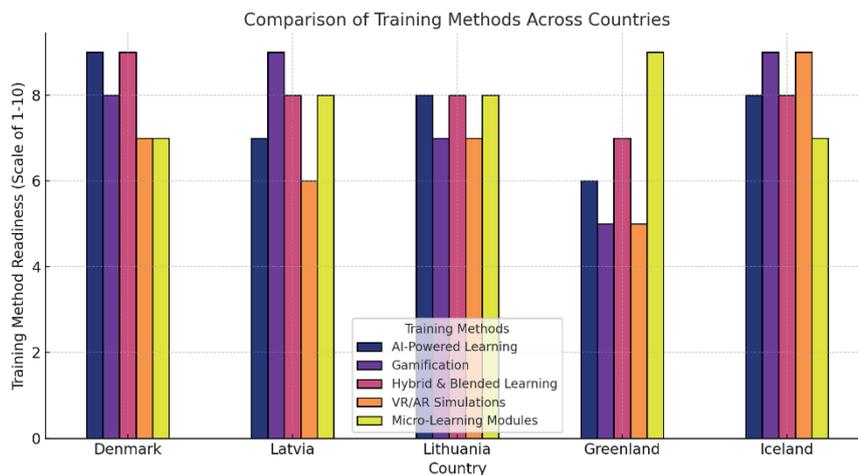- Greenland: Overcoming geographical barriers with digital learning.

*Figure 3 **Comparison of Training Methods Across Countries** (the author Anna Högnadóttir with use of OpenAI, 2023)*

Comparative Case Study Findings from Nordic-Baltic Countries

The findings from the qualitative interviews highlight key challenges and propose training solutions across the countries of Denmark, Greenland, Iceland, Latvia, Lithuania.

Table 1 summarises the key challenges identified through stakeholder interviews and the corresponding proposed training solutions in Denmark, Greenland, Iceland, Latvia, Lithuania.

Table 1 **Comparative Insights from the Implemented Interviews** *(the author Anna Högnadóttir)*

Country	Key Challenges Identified in Interviews	Proposed Training Solutions
DK Denmark	AI adoption barriers in vocational education	AI-driven learning platforms
LV Latvia	Low engagement in adult learning programs	Government-funded training
LT Lithuania	Lack of sustainability training integration	New green economy courses
GL Greenland	Limited digital access in remote areas	AI-supported distance learning
IS Iceland	Resistance to AI-based training	Incentives for educators

Case Study 1: Denmark – AI-Driven Adaptive Learning in Adult Education. Key findings are that Denmark is a leader in AI-powered education solutions, integrating intelligent learning algorithms to personalise training and support vocational education. The training model includes

- Hybrid learning,
- AI-assisted teaching,
- Gamified training.

A respondent during the semi-structured interview in Denmark emphasized that by 2050, education will be fully digital, requiring lifelong learning strategies.

Case Study 2: Latvia – Emotional Intelligence and Digital Learning. Key findings encompass Latvia's approach to adult education that focuses on digitalisation and emotional intelligence development to support future workforce needs. The training model is built on

- Project-based AI learning,
- Gamification,
- Blended models.

A respondent from Latvia highlighted that emotional intelligence is as critical as technical skills in the future of learning.

Case Study 3: Lithuania – Robotics and Technical Training Innovations. The key findings reveal that Lithuania is investing heavily in robotics and automation to align workforce training with the digital economy. The training model is composed of

- VR-based skill assessments, and
- Hands-on robotics training.

A respondent from Lithuania noted that automation will redefine how trainers teach and how learners adapt to new technologies.

Case Study 4: Greenland – Overcoming the Digital Divide in Remote Learning. The key findings present that Greenland faces significant geographical barriers to digital learning, necessitating AI-assisted remote education solutions. The training model is based on

- AI-powered micro-learning, and
- Hybrid solutions.

A respondent from Greenland opined that lifelong learning must be inclusive, even in remote areas.

Case Study 5: Iceland – Gamification and Virtual Reality in Training. The key findings allow stressing that Iceland has pioneered gamification and VR-based learning as innovative methods to improve adult education outcomes. The training model is established on

- Simulation-driven vocational training, and
- Gamification tools.

A respondent from Iceland noted that gamification makes education interactive, immersive, and learner-centric.

Discussion

Integration of the case study insights into broader research illustrate the diverse approaches that Nordic-Baltic countries are taking to adapt adult education to the Twin Transition.

The key sustainability values – sustainable processes and sustainability results – for adult education to be also applicable in 2050 are identified (Ahrens et. al., 2024).

It is worth pointing that the opinion similar to the interoperability, as the key feature of adult educators' qualification, was expressed by UNESCO (2021). UNESCO (2021) considers that teaching should become a collaborative profession where teamwork ensures meaningful student learning.

What refers to digitalisation of adult education, our research shows that while some nations are leading in AI-driven learning (Denmark, Iceland), others are addressing digital access issues (Greenland) or developing workforce-relevant sustainability training (Latvia and Lithuania).

Analysis of comparative policy and stakeholder contributions, reflected in Figure 4, implemented within the interviews of this study allows finding substantial variation in policy implementation across the Nordic-Baltic region.

Denmark leads in AI adoption, largely due to strong government-industry collaborations, whereas Greenland faces challenges in digital accessibility due to infrastructure limitations.

Policy comparisons across the countries participating in the study reveal:
- Denmark: Industry-academia partnerships for AI & sustainability,
- Latvia & Lithuania: Government-supported upskilling initiatives,
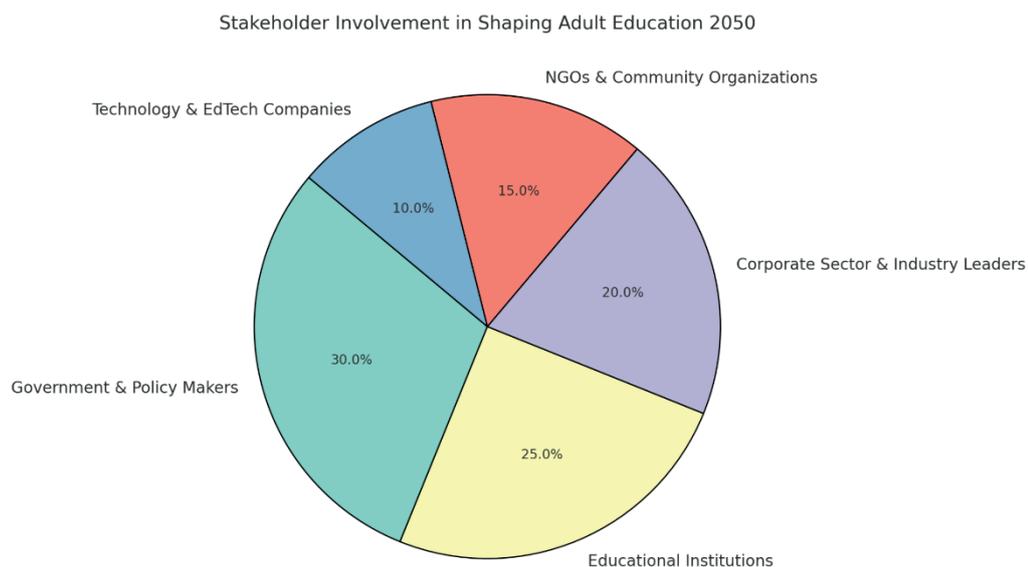- Greenland & Iceland: Private-sector-driven digital transformation.

*Figure 4 **Stakeholder Involvement in Adult Education** (the author Anna Högnadóttir with use of OpenAI, 2023)*

Conclusions

The theoretical and empirical analysis allow concluding that by 2050, competent performance, digital literacy and sustainability expertise will be fundamental in workforce training.

The present work carried out within the SMART MAP project highlights the crucial role of adult trainers in facilitating the Twin Transition. Adult educators' interoperability becomes a key feature of adult educators' qualifications.

The interview results show that technical, cognitive, and socio-emotional skills will shape the competence framework for adult education in 2050. This finding allows concluding that the balance of both hard (technical skills) and soft skills (cognitive and socio-emotional skills) in adult education has to be provided. Another conclusion is that adult education has to consider technical skills in light of STEM (Science, Technology, Engineering, Mathematics) or even STEAM (Science, Technology, Engineering, Art, Mathematics) skills due to the increasing importance of interoperability.

This study reveals the necessity for cross-border collaboration in developing strategic frameworks on adult education 2050.

Additionally, this study acknowledges several research limitations. First, focusing on Nordic-Baltic countries limits broader applicability, necessitating comparative research with Southern or Western European models. Second, the interview sample, though diverse, may reflect institutional biases in interpreting training needs. Future studies should explore longitudinal workforce transformations to capture evolving skill demands.

Future research should explore broader policy implementation strategies beyond the Nordic-Baltic region. Further studies should examine the intersection of sustainability and AI-driven education, addressing unresolved ethical considerations. Future policy interventions should focus on scaling best practices across borders, ensuring that digital and green competencies are universally accessible.

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