



D2.3 ADS ACTIONS ANNUAL REPORT YEAR 1

Work package	WP 2 (TCD)
Task	T2.3 Collect, analyse, and produce annual reports of ADS Analysis (TCD, BLU)
Due date	15/07/2025
Submission date	14/07/2025
Deliverable lead	Na Fu (TCD)
Version	V1.0
Lead Author (Org)	Na Fu (TCD)
Contributing Authors (Org)	Mai Hoang (TCD), Cristian Salis (BLU), Julie Byrne (TCD)
Reviewers	Ana Maria Moreno (UPM), Andrea Biancini (EITD)

DOCUMENT REVISION HISTORY

Version	Date	Description	List of Contributors
0.1	25/04/2025	ToC	Na Fu (TCD)
0.2	26/05/2025	First draft with structure and preliminary findings	Na Fu (TCD), Julie Byrne (TCD), Mai Hoang (TCD)
0.3	16/06/2025	Qual. findings	Na Fu (TCD), Julie Byrne (TCD), Mai Hoang (TCD)
0.4	18/06/2025	Quan. findings	Cristian Salis (BLU)
0.5	25/06/2025	Additional information on the key findings.	Mai Hoang (TCD)
0.6	28/06/2025	Full draft for peer review	Na Fu (TCD)
0.7	01/07/2025	Peer review	Ana M. Moreno (UPM)
0.8	03/07/2025	Peer review	Andrea Biancini (EITD)
1.0	07/07/2025	Incorporated peer review feedback and final release	Na Fu (TCD), Mai Hoang (TCD)

DISCLAIMER

The information, documentation and figures available in this deliverable are written by the "Leading European Advanced Digital Skills to 2030" (LEADSx2030) consortium under EC grant agreement 101189966 and do not necessarily reflect the views of the European Commission. The European Commission is not liable for any use that may be made of the information contained herein.

COPYRIGHT NOTICE

© 2024 - 2028 LEADSx2030 Consortium

Project funded by the European Union in the Digital Europe Programme (DIGITAL)		
Nature of deliverable:	R - REPORT	
Dissemination level		
PU	Public, fully open, e.g. web	X
SEN	Sensitive, limited under the conditions of the Grant Agreement	
Classified R-UE/ EU-R	EU RESTRICTED under the Commission Decision No2015/ 444	
Classified C-UE/ EU-C	EU CONFIDENTIAL under the Commission Decision No2015/ 444	
Classified S-UE/ EU-S	EU SECRET under the Commission Decision No2015/ 444	

ABSTRACT

The ADS Annual Report Year 1 (D2.3) delivers a comprehensive analysis and strategic recommendations for stakeholders engaged in advancing Advanced Digital Skills (ADS) across Europe. Building on the ADS analytical framework (D2.1), this report draws on data collected through a mixed-methods approach: a complete survey of all 32 DIGITAL-SO4 funded actions (20 Specialised education programmes and 12 Short-Term Training courses funded between 2021 and 2022) and in-depth interviews with 18 project coordinators (representing 55–58% of both types of projects).

The report begins by establishing the context and objectives, underscoring its role in evaluating, informing, and strengthening ADS initiatives. It details the rigorous research methodology that combines quantitative survey results with qualitative insights from interviews. The findings provide a clear picture of the current DIGITAL-SO4 project portfolio, highlighting significant progress and innovative approaches in ADS education design and delivery. They also identify persistent challenges and offer evidence-based solutions.

This report offers strategic, actionable recommendations to support decision-makers, promote collaboration, and enhance the effectiveness of future ADS initiatives. It serves as an essential baseline for monitoring the impact and evolution of DIGITAL-SO4 funded actions. By producing annual updates, the project aims to establish a robust, longitudinal evidence base capable of tracking trends, guiding policy, and fostering a dynamic, collaborative ecosystem between higher education institutions, research organisations, and other stakeholders committed to ADS in Europe.

TABLE OF CONTENTS

1	INTRODUCTION.....	6
1.1	CONTEXT	6
1.2	PURPOSE OF THIS DOCUMENT	6
1.3	TARGET AUDIENCE.....	6
1.4	RELATION TO OTHER PROJECT DELIVERABLES.....	7
2	METHODOLOGY	8
2.1	INTRODUCTION.....	8
2.2	DATA COLLECTION OVERVIEW	8
2.2.1	<i>Quantitative data collection</i>	<i>9</i>
2.2.2	<i>Qualitative data collection</i>	<i>10</i>
2.3	SUMMARY	12
3	ANALYTICAL OVERVIEW OF THE SO4 ADS PROJECTS PORTFOLIO	13
3.1	INTRODUCTION.....	13
3.2	DESCRIPTIVE ANALYSIS	13
3.3	KEY FINDINGS OF QUANTITATIVE DATA.....	16
4	CHALLENGES AND OPPORTUNITIES IN PROGRAMME AND PROJECT MANAGEMENT	18
4.1	INTRODUCTION.....	18
4.2	MAIN THEME 1: COURSE/PROGRAMME COMPLETION, PASSING & EMPLOYMENT RATES.....	18
4.2.1	<i>High pass rates indicating high quality of learning.....</i>	<i>19</i>
4.2.2	<i>Participant profile data being collected and available.....</i>	<i>20</i>
4.2.3	<i>Employability data: Awareness, but difficult to track</i>	<i>21</i>
4.3	MAIN THEME 2: EFFECTIVE QUALITY ASSURANCE MANAGEMENT	22
4.3.1	<i>Quality assurance in place as a standard</i>	<i>22</i>
4.3.2	<i>Standardisation top-down approach challenges</i>	<i>23</i>
4.3.3	<i>Standardisation bottom-up approach at the project level</i>	<i>24</i>
4.4	MAIN THEME 3: RESOURCES AND COOPERATION	25
4.4.1	<i>High level of resource readiness & strong industry collaboration.....</i>	<i>25</i>
4.4.2	<i>Challenges for SME involvement (finance)</i>	<i>27</i>
4.4.3	<i>Sustainable growth involves industry, but lacks preparation to take off.....</i>	<i>28</i>
4.5	MAIN THEME 4: PARTICIPANTS' EXPECTATIONS & RECOMMENDATIONS.....	29
4.5.1	<i>Knowledge sharing</i>	<i>29</i>
4.5.2	<i>Quality assurance management</i>	<i>31</i>
4.5.3	<i>Resources and cooperation</i>	<i>32</i>
4.6	KEY FINDINGS OF QUALITATIVE DATA.....	33
5	RECOMMENDATIONS.....	35
6	SUMMARY	37

REFERENCES	38
ANNEX A. INTERVIEW GUIDE	39
ANNEX B. ADDITIONAL QUOTES FOR THE MAIN THEME 1: COURSE/PROGRAMME COMPLETION, PASSING & EMPLOYMENT RATES	41
ANNEX C. ADDITIONAL QUOTES FOR THE MAIN THEME 2: EFFECTIVE QUALITY ASSURANCE MANAGEMENT	44
ANNEX D. ADDITIONAL QUOTES FOR THE MAIN THEME 3: RESOURCES & COOPERATION	48
ANNEX E. ADDITIONAL QUOTES FOR THE MAIN THEME 4: PARTICIPANTS' EXPECTATIONS & RECOMMENDATIONS	52

LIST OF FIGURES

Figure 1. DIGITAL-SO4 ADS Projects Portfolio4

Figure 2. ADS Analytical Framework components overview8

Figure 3. Sample project profile.....11

Figure 4. Type of courses allowed.....13

Figure 5. Course breakdown by implementation stage.....14

Figure 6. Course breakdown by delivery mode14

Figure 7. Number of courses by time band (hours).....15

Figure 8. Course breakdown by technology area15

Figure 9. Course breakdown by sector16

Figure 10. Courses hosted by country16

Figure 11. Coding Framework of Qualitative Analysis18

LIST OF TABLES

Table 1.1. Types and Scale of Actions in the SO4 Cluster^a5

ABBREVIATIONS

ADS	Advanced Digital Skills
AI	Artificial Intelligence
BLU	BluSpecs
CSA	Coordination and Support Action
DIGITAL	Digital Europe Programme
DLT	Distributed Ledger Technologies
DSJP	Digital Skills and Jobs Platform
ECTS	European Credit Transfer and Accumulation System
EDI	Equity, Diversity and Inclusion
EITD	EIT Digital
EQAR	European Quality Assurance Register for Higher Education
EUROHPC	European High Performance Computing Joint Undertaking
EU-27	27 European Union member states
HRDA	Human Resource Development Authority
ICT	Information and Communication Technology
KPI	Key Performance Indicator
MOOC	Massive Online Open Course
QA	Quality Assurance
SME	Small and Medium Enterprise
SO4	Strategic Objective 4 of the Digital Europe Programme
TCD	Trinity College Dublin
UPM	Universidad Politécnica de Madrid
WP	Work Package

ABOUT LEADSX2030

LEADSx2030 is a Coordination and Support Action (CSA) funded under the Advanced Digital Skills (ADS) Strategic Objective 4 (SO4) of the DIGITAL Programme. As a CSA, it is tasked with:

- Delivering insights into the changing ADS demands in the EU, and determining to what extent the current education and training offers match the needs of the current and future labour market.
- Recommending priority areas for new funding programmes and giving indications on which type of programmes and training is most effective for building up ADS.
- Supporting excellence in education and training institutions, aiming at the development of a dynamic digital education and training ecosystem.
- Promoting collaboration among the SO4 Cluster, i.e. the consortia awarded from the different call topics under the DIGITAL SO4.

As such, over a period of 48 months LEADSx2030 will:

- Provide a continuous review of demand and supply changes related to ADS.
- Map the outputs of the SO4 Cluster to identify key results and success stories.
- Develop the SO4 Cluster into a dynamic network.
- Provide opportunities for synergies with relevant European actors.
- Bring all stakeholders together in point-of-reference annual ADS summits.
- Support the strategic EU policy objectives through targeted analyses and recommendations.

Latest information about the initiative can be found at www.advancedskills.eu.

DIGITAL SO4 ADS CLUSTER

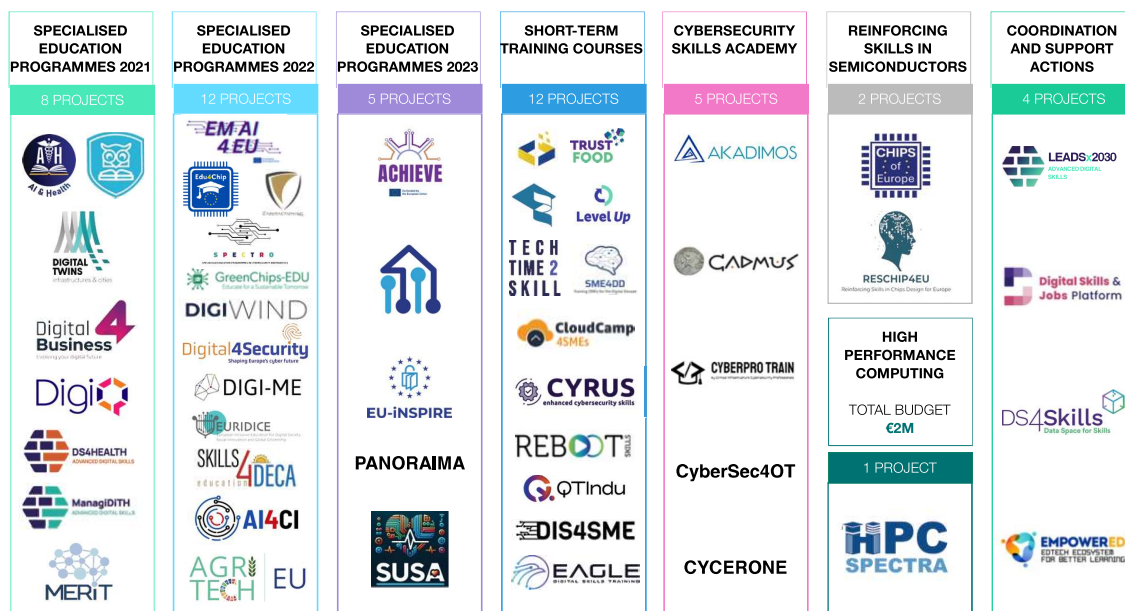
The DIGITAL programme was conceived with the aim of empowering citizens with ADS and preparing them to tackle current societal challenges. Up to 2024, it has invested €287M for actions on ADS in key capacity areas within the 2021- 2027 period.

In terms of advanced digital skills, the DIGITAL programme's Strategic Objective 4 (SO4) states:

*"Advanced Digital Skills shall support the development of Advanced Digital Skills in areas covered by the Programme in order to contribute to increasing Europe's talent pool, bridge the digital divide and foster greater professionalism, especially with regard to High Performance and Cloud Computing, Big Data Analytics, Cybersecurity, Distributed Ledger Technologies (DLT), Quantum Technologies, Robotics, Artificial Intelligence (AI), while taking gender balance into account."*¹

Under the SO4 there is an extensive portfolio of 45 projects (Figure 1), focused on the delivery of new ADS programmes. These include Specialised Master's programmes and courses, Short-Term Training courses, a Cybersecurity Skills Academy, programmes for Reinforcing Skills in Semiconductors, and a EuroHPC training platform for High-Performance Computing. Table 1 presents the number and funding source for these projects.

Figure 1. DIGITAL-SO4 ADS Projects Portfolio



The main target areas, for which these programmes aim to improve the supply of ADS, include Cybersecurity, Artificial Intelligence (AI), Manufacturing and Infrastructure, Business Innovation, SMEs and Digital Health. Other notable areas are Energy and Sustainability, Public Administration, and Semiconductors.

More information on the Cluster projects can be found at the [Digital Europe Programme dashboard](https://digital-europe-programme-dashboards.eu).

¹ <https://eur-lex.europa.eu/eli/dec/2022/2481/oj>

Table 1.1. Types and Scale of Actions in the SO4 Cluster^a

Topic code	No. projects	Duration	EU funding	Total budget ^b
Specialised education programmes and courses in key capacity areas				
DIGITAL-2021-SKILLS-01-SPECIALISED	8	2022-2026	€56.5M	€103M
DIGITAL-2022-SKILLS-03-SPECIALISED-EDU	12	2023-2027	€78.2M	€125.5M
DIGITAL-2023-SKILLS-05-SPECIAL-EDU	5	2024-2029	€32.6M	€35.3M
Short-term training courses in key capacity areas				
DIGITAL-2022-TRAINING-02-SHORT-COURSES	12	2022-2025	€24.3M	€40.5M
Cybersecurity skills academy				
DIGITAL-2023-SKILLS-05-CYBERACADEMY	5	2024-2027	€11.7M	€22.8M
Reinforcing skills in semiconductors				
DIGITAL-2023-SKILLS-04-CHIPS	2	2024-2028	€9.1M	€18.3M
EuroHPC training platform				
DIGITAL-EUROHPC-JU-2022-TRAINING-02	1	2024-2025	€2M	€2M
Total	45	2022-2029	€214.4M	€347.4M

Note: ^aThe main target areas The following table includes the funded actions under the remit of LEADSx2030, and not necessarily all actions funded under Strategic Objective 4 (SO4). These numbers account for the total EU-funding requested and the total investment including co-funding from other sources and private investment.

1 Introduction

1.1 Context

As part of WP2: ADS Longitudinal Analysis, this work aims to deliver a robust, long-term evaluation of the DIGITAL SO4 ADS Cluster. The objectives are twofold: to provide a longitudinal analysis of project activities and to deliver a gap analysis with clear, actionable recommendations for enhancing key offerings, delivery quality, and overall impact. To achieve this, LEADSx2030 has employed a multifaceted research strategy. Building on the D2.1 ADS Actions Analytical Framework and the survey-based D2.2 ADS Actions Dataset, the team also conducted in-depth interviews with coordinators of SO4-funded projects.

This report presents a comprehensive analysis that integrates quantitative survey data with rich qualitative insights from interviews. By reporting key findings and offering strategic recommendations, the Report is intended to support the development of a sustainable and dynamic ecosystem linking higher education institutions with research and industry partners. As the first in a series of annual reports, it also establishes the baseline for ongoing longitudinal monitoring, enabling consistent tracking of progress, challenges, and trends over time.

1.2 Purpose of this document

This report presents timely insights into current ADS offerings by constructing the ADS Actions Dataset enriched with extensive details for DIGITAL-SO4 funded actions. It details the methodologies of data collection and analysis deployed to assess the progress and impacts of all DIGITAL-SO4 actions. This report enables ongoing examination of the ADS supply using the approved D2.1 ADS Analytical Framework for future, which helps identify evidence-based practices on generating a robust relationship among all stakeholders involved and developing future policy and programme design.

Furthermore, the report aims to contribute to the creation of a centralised Data Hub for SO4 ADS community, which facilitates the integration of disparate data sources and provides insight dashboard of the changing requirements for ADS for different stakeholders. Through the consultative data collection and analysis, the Data Hub will be able to develop a series of benchmarks against skills areas, tech scope, programme format, etc., which allows for an objective self-assessment and matching of initiatives and synergies.

1.3 Target audience

The target audience include:

- **LEADSx2030, ADS and DIGITAL Project Partners:** The report will enable partners to systematically gather inputs on the existing education and training offers in the ADS area, identifying areas for stronger collaboration and improvement. It will also serve as a tool to guide future actions, help partners optimise strategies and enhance the effectiveness of ADS education.
- **Policy Makers:** The report will provide a comprehensive overview of ADS education programs. It will inform policy decisions by highlighting successful initiatives that can be scaled or replicated to address multi-level challenges.

- **Education & Training Providers:** By offering evidence-based insights, the report will help education and training providers design or enhance digital skills programmes. It will support them in developing curricula that are responsive to the evolving demands of the labour market and the needs of learners.
- **General Public:** The report will increase public awareness of the impact of digital skills education, demonstrating its importance for employability and economic growth. It will also provide insights into how these programmes align with current labour market trends and job opportunities.

1.4 Relation to other project deliverables

D2.3 ADS Actions Annual Report Year 1 is closely linked to other deliverables within the LEADSx2030 project, creating a cohesive evaluation and reporting process. Specifically:

- D1.2 ADS Data Hub: The Data Hub will provide input to the Annual Report regarding key skills in the current SO4 ADS programme portfolio.
- D2.1 ADS Analytical Framework: The Framework provides the comprehensive approach to structuring and analysing DIGITAL SO4 funded actions. It guides the data collection and evaluation processes that shape the Annual Report.
- D2.2 ADS Actions Dataset: The Dataset provides the quantitative data for analysis in the Report.
- D3.3, D3.5, D3.7 ADS Cluster Report: The findings and recommendations from the Annual Report will feed into ADS Cluster Annual Reports which will provide qualitative analysis of the DIGITAL-SO4 ADS Cluster and outline opportunities for synergies within the cluster identified best practices, and sub-cluster actions.
- D4.1-D4.4 ADS Network Reviews: The findings and recommendations from the Annual Report will feed into ADS Network Annual Reviews which will review the key stakeholders in the European and global ADS ecosystem.
- D5.1 ADS State-of-Play Report: The findings and recommendations from the Annual Report will feed into the ADS State-of-Play Report which will provide information on the ADS demand and supply by sectors and roles, existing gaps, key statistics and expert opinions.

2 Methodology

2.1 Introduction

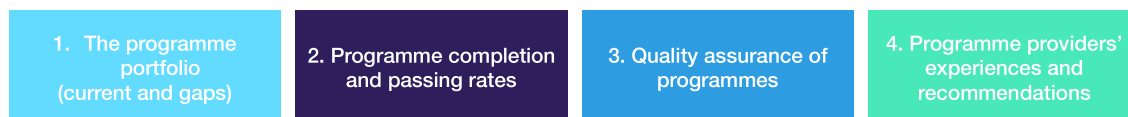
This section introduces the methodology drawn on the ADS Analytical Framework (D2.1) to deliver a Longitudinal Analysis of DIGITAL SO4 funded actions and provide a comprehensive analysis with actionable recommendations for enhancing programme offerings, delivery, and impact. A mixed method which consists of both quantitative survey and qualitative interviews is deployed to collect data on various aspects such as course/programme portfolios, completion and employment rates, quality assurance, and key discussion topics with coordinator institutions and providers, including best practices, challenges, and financial considerations.

2.2 Data collection overview

LEADSx2030 aims to deliver a longitudinal analysis of SO4 ADS Cluster activities and provide a gap analysis with actionable recommendations for enhancing programme offerings, delivery, and impact. The data collection incorporates the Analytical Framework (D2.1) to include the following core components for analysis as shown in Figure 2:

1. Course/Programme Portfolio: A comprehensive review of available offerings within the ADS Cluster.
2. Course/Programme Completion, Passing & Employment Rates: Evaluation of learner outcomes and employability metrics.
3. Quality Assurance of Courses/Programmes: Assessment of the mechanisms ensuring programme quality and relevance.
4. Key Discussion Points with Coordinator Institutions and Programme Providers: Identification of areas for collaboration and improvement.

Figure 2. ADS Analytical Framework components overview



For quantitative method, the ADS Actions Dataset (D2.2), which consolidates information of all DIGITAL-SO4 funded projects, serves as the data source for descriptive analysis, providing a comprehensive overview of the programme portfolio. This Dataset is collected from both primary (project coordinators) and secondary (publicly available) sources. For qualitative method, the research team conducted semi-structured interviews with DIGITAL-SO4 project coordinators. An interview guide was developed based on the ADS Analytical Framework (D2.1) to ensure collection of comprehensive insights into programme offerings and contextual understanding to complement the brochure data. Drawing on a rigorous thematic analysis² in NVivo (a qualitative data analysis software) the results present four key themes. They include the programme learning outcomes, assuring quality, mobilising resources, and planning for sustainability. Accordingly, the findings identify best practices

² Braun and Clarke (2006)

for future collaboration and improvement. The following sub-sections provide detailed information on the data collection and analysis.

2.2.1 Quantitative data collection

2.2.1.1 Quantitative data collection process

For the first component of the programme portfolio, the research team adopted quantitative methodology to collect and analyse the data of all DIGITAL-SO4 funded actions. A dataset was developed under the ADS Analytical Framework (D2.1) as the ADS Actions Dataset (D2.2). This Dataset consolidates existing information of the 32 funded actions between 2021 and 2022 as these projects have designed and delivered ADS courses and programmes at the data collection time (Feb-Apr 2025).

2.2.1.2 Data sources and method

The dataset includes data for DIGITAL-SO4 funded actions through the 2021 and 2022 open calls, specified as followed.

- 20 Specialised education projects (8 in 2021, 12 in 2022).
- 12 Short-Term Training course projects.
- 449 programmes or courses delivered by these projects.

The data were collected from both the primary and secondary sources. First, the research team collected secondary data from publicly available information on the respective project websites. Doing so helps the participants to save time as well as to identify the gap between their promotion and current offers. Individual invitations and regular reminders were then sent to all project coordinators to complement the dataset to ensure accuracy and reliability. In addition, ADS webinar promotion and final check-in were conducted to reinforce the contribution efforts. This was an ongoing process of communication and collaboration between the research team and project coordinators to jointly contribute to the final dataset, leading to 25 projects' Dataset validated by primary sources while other 7 projects updated based on secondary data.

The following elements will be assessed at course/programme level.

WHAT IS BEING DELIVERED

- SO4 Topic Code, Project ID, Project Acronym, and Project Name
- Type of course/programme¹
- Course/programme name
- Is one course/programme being delivered, or a programme(s) containing multiple courses/modules? (specify number of courses/modules)²
- Delivery language(s)
- Course/programme Duration³
- Is the course/programme Accredited? (Yes/No)
- Accreditation type⁴
 - Number of ECTS (if any)
- Sector(s) at which course/programme is targeted⁵.
- Skill in ADS (List the following: Technology Group⁶, Skills Group⁷, Level of Skills⁸).

HOW THEY ARE BEING DELIVERED

- Delivery mode(s)⁹
- Is the course/programme delivered at one location, or jointly between two or more locations?
 - List Delivery location(s), and Max. Capacity¹⁰
- Are identical/similar instances of the course/programme delivered at multiple locations?
 - List Delivery location(s), and Max. Capacity per location
- Name, Location, and Type (Education & Training¹¹, Industry¹², Public body¹³, Research¹⁴, Other¹⁵) of each organisation involved in delivering the course/programme¹⁶ (if Industry organisations are involved in delivery state if they are a consortium member)

PARTICIPANTS

- Student admission criteria
- Brief description of target profile of learners

2.2.1.3 Quantitative data analysis

Descriptive analysis is employed in this section to give a comprehensive overview of the programme portfolio. The analysis provides a breakdown on different aspects across the 32 training-delivering projects in terms of the type of courses/programmes, implementation stage, delivery mode, course duration, technology area, sector and host countries.

This analysis serves as the foundation to assess the progress and impact of the 32 DIGITAL SO4 funded actions in ADS education. It facilitates the identification of key trends and patterns within the programme portfolio, highlighting the focus areas and potential gaps in the current offerings. Collectively, these diverse insights help to inform strategic recommendations to enhance the effectiveness and outreach of the programme offerings, ensuring iterative refinement and alignment with the overarching project goals.

2.2.2 Qualitative data collection

2.2.2.1 Qualitative data collection process

To gather more extensive insights into the programme context from coordinators, a qualitative method with in-depth interviews was employed. The interview was semi-structured using an interview guide that was drawn on the ADS Analytical Framework (D2.1). The interview guide covered key discussion topics including completion and employment rates, quality assurance, resourcing and cooperation and sustainability. Invitations were sent to all project coordinators with follow up reminders, resulting in 18 coordinators' responses. Interviews were conducted between April and May 2025. All interviews were recorded, transcribed, and anonymized for analysis.

2.2.2.2 Interview guide and sample project profile

The interview guide comprising 14 questions was developed based on ADS Analytical Framework (D2.1) to explore in-depth contextual understanding from project coordinators (see Annex A). The questions cover three broad areas on completion and employment rates, quality assurance, and key discussion topics with coordinator institutions and providers, including best practices, challenges, and financial considerations. After invitations were sent out, 18 project coordinators accepted to

participate in the interviews and their profiles are illustrated in Figure 3 as below. They represented 11 Specialised education projects (55%) and 7 Short-Term Training course projects (58%).

Upon the completion of the first few interviews, the research team met to discuss findings, re-analyse previous interviews and determine if any additional or different questions might be posed in subsequent interviews.

Figure 3. Sample project profile



2.2.2.3 Qualitative data analysis

A thematic analysis was carried out by the research team to identify, analyse, and report patterns within the interview transcripts. This process involved several meetings between the research team to ensure a valid and trustworthy analysis of the data. Each member of the research team read all interview transcripts to familiarise themselves with the data and acquire a high-level understanding of each participant's experience.

During the first meeting, the team discussed the initial codes, identified and reached an agreement on a coding framework of four key findings around how projects are tracking learning outcomes, assuring quality, mobilising resources, and planning for sustainability. Each finding comprises three themes and various sub-themes, which served as the coding scheme for importing into NVivo to start coding the initial four interviews. This iterative process allowed for the refinement of the framework and the generation of additional codes which were not previously discussed.

After completing the initial four interviews, a second meeting was held to define themes and sub-themes and finalise the coding framework. The remaining 14 interviews were then coded by the team. Finally, a final meeting was held to discuss the analysis results and aggregate the codes into their respective themes and sub-themes in the report.

2.3 Summary

This chapter presents the methodology deployed to conduct a Longitudinal and Gap Analysis of SO4 ADS Cluster activities, guided by the ADS Analytical Framework (D2.1). Both quantitative and qualitative methods were applied to evaluate programme portfolios, learner outcomes, quality assurance, and institutional practices.

Quantitatively, data from 32 DIGITAL SO4 funded actions (2021 – 2022) were compiled into the ADS Actions Dataset (D2.2), covering 449 courses. Data sources included project coordinators and publicly available information. Descriptive analysis examined delivery types, duration, modes, technology areas, and target sectors to identify trends and gaps across the programme landscape.

Qualitatively, semi-structured interviews with 18 project coordinators explored deeper contextual insights. Guided by the framework, interviews covered topics such as completion rates, employability, quality assurance, resource mobilisation, and sustainability. Thematic analysis revealed four core areas of focus, with themes and subthemes developed collaboratively to inform actionable recommendations for strategic development and future improvement.

3 Analytical overview of the SO4 ADS projects portfolio

3.1 Introduction

The ADS projects portfolio, funded under SO4 of the DIGITAL programme, offers an extensive list of trainings that differ significantly in terms of maturity, format, content and objectives. Although on a project-level a lot of information is publicly available on the respective project websites or directly reported through deliverables and official reviews, little information is available regarding the individual programmes or courses they provide.

The comprehensive Dataset, built by LEADSx2030, sheds light on the offering of the ADS projects portfolio. The Dataset includes information collected from the 32 projects funded through the 2021 and 2022 open calls. At the time of data collection, subsequently funded actions were still at an early stage; data from these projects will be incorporated in the future iterations of the Dataset and Report.

3.2 Descriptive analysis

Across the 32 training-delivering projects, 465 trainings have been designed. These include academic and professional master's degrees, short-term courses, life-long learning courses, micro credentials, individual modules and MOOCs (Figure 4).

79% of them have already been launched (some have already produced graduates, while others are still ongoing) as of June 2025, while 21% remain in preparation (Figure 5). This reflects the different starting dates of the projects, but also the iterative development of content. The 'AI and Health' project, for example, is already delivering master's programmes, while preparing to launch a Massive Online Open Course (MOOC) and customised professional courses.

Figure 4. Type of courses allowed

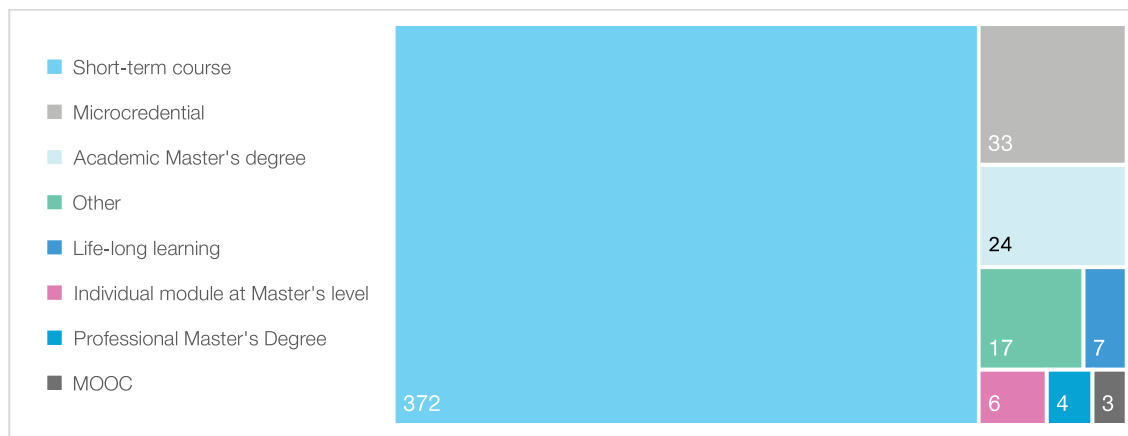
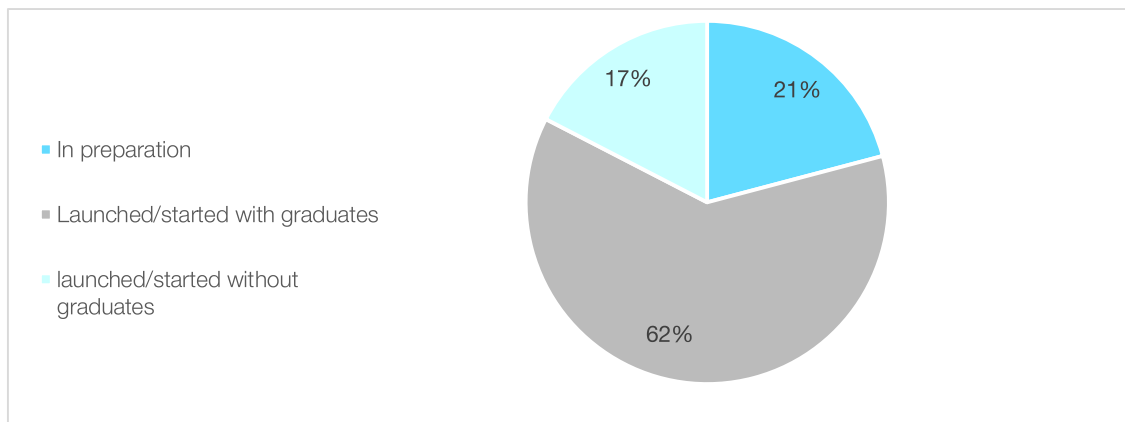
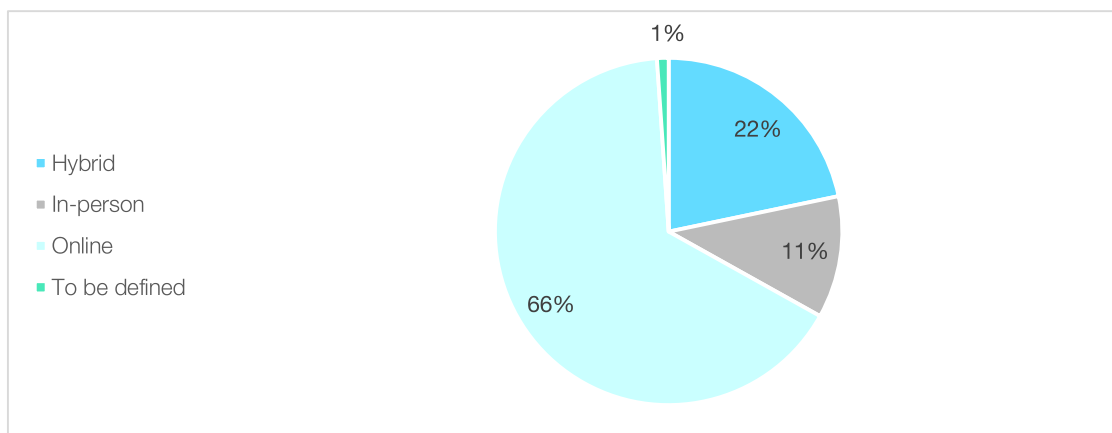


Figure 5. Course breakdown by implementation stage



The majority of trainings are delivered online (66%) (Figure 6). This percentage is driven up by short-format courses, including life-long learning courses, individual modules, micro credentials and MOOCs. Long-format programmes, such as master's and bachelor's degrees, are typically delivered in-person or in hybrid mode. A detailed breakdown of training by type and delivery mode is available in Annex B.

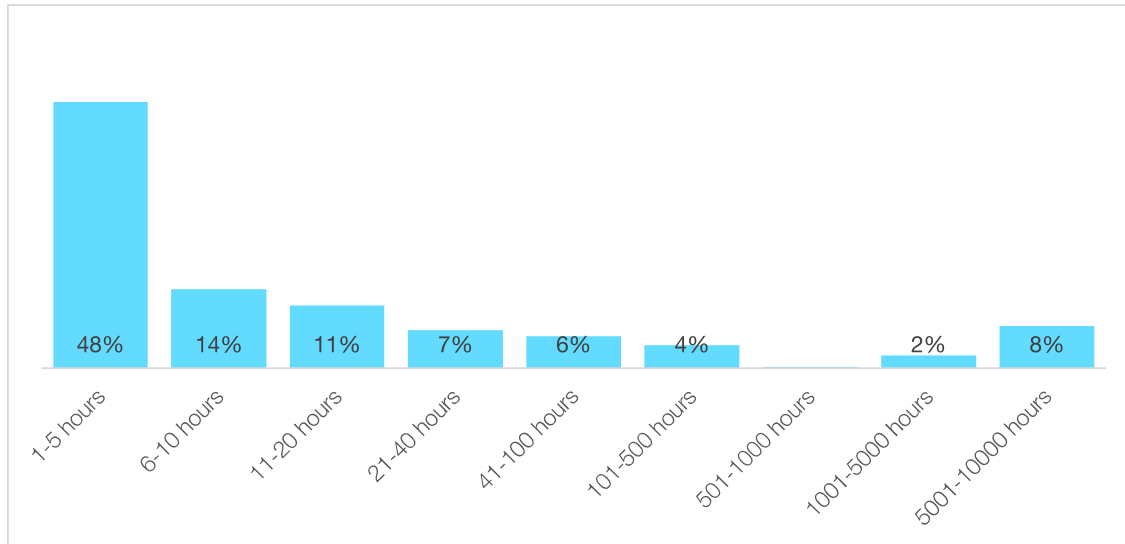
Figure 6. Course breakdown by delivery mode



As the significant prevalence of short-term courses and micro credentials would imply, the duration of the trainings within the ADS projects portfolio is skewed. Approximately half of the trainings (48%) last between 1 to 5 hours. Another 14% last between 6 to 10 hours and 11% last between 11-20 hours. In total, 90% of all trainings can be completed within less than 500 hours.

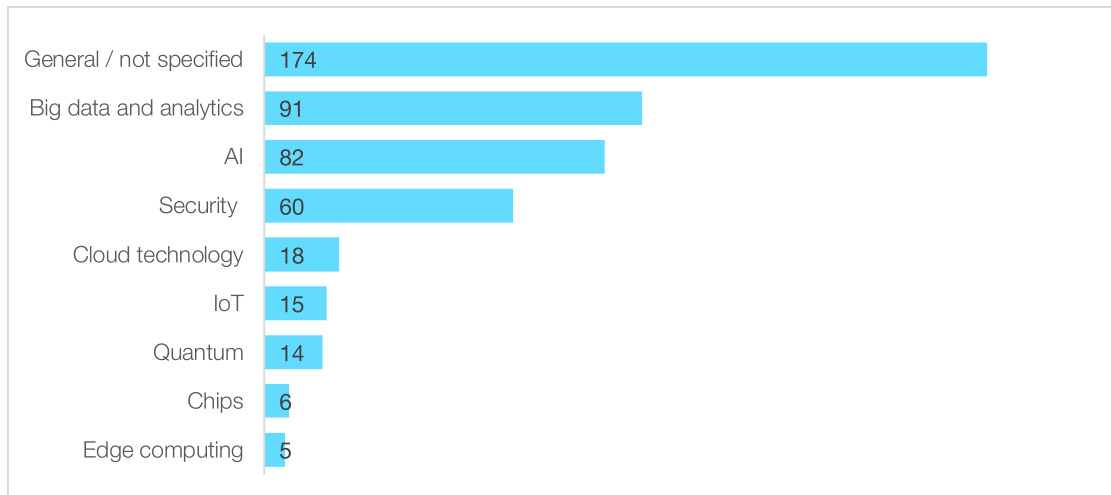
As derived from discussions with project coordinators and representatives, in the context of community meetings, such as the DIGITAL projects meeting (Luxembourg, 17-18th March 2025) or the regular LEADSx2030 sub-cluster calls, the short duration of the trainings (shown in Figure 7) reflects the reluctance or inability of SMEs to provide longer courses to their employees and, hence, the need for self-standing, digestible materials that can easily incorporated to the existing workload.

Figure 7. Number of courses by time band (hours)



The trainings contribute towards ADS in a wide range of technology areas (Figure 8). The majority are general, transferrable ADS, followed by ADS for Big Data and Analytics, AI, and Security.

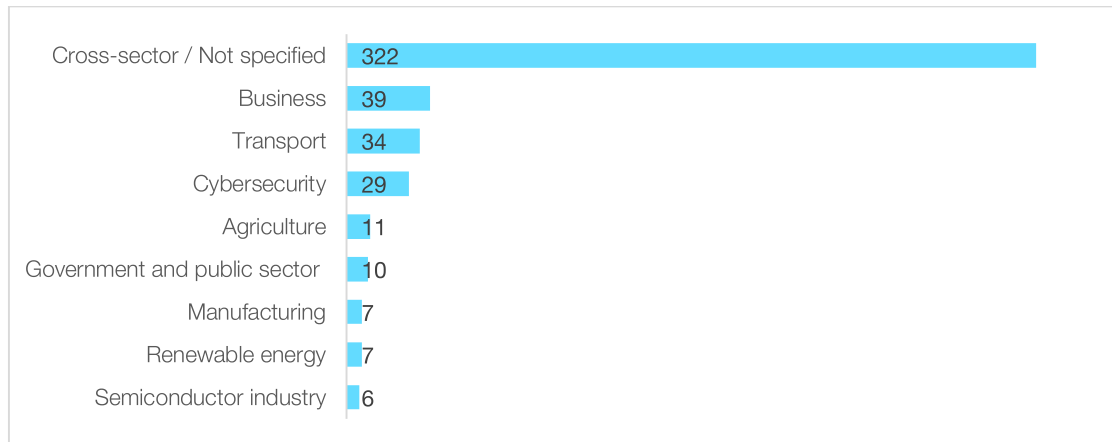
Figure 8. Course breakdown by technology area



Although the majority of trainings are cross-sectoral, many of them address the ADS needs of specific verticals, including Business, Transport, Cybersecurity, Agriculture, Government and Public Sector (Figure 9). Manufacturing, Renewable Energy and Semiconductors are also present. Monitoring the evolution of the Cluster since the funding of the first programmes in 2021, LEADSx2030 has observed a shift from more generic trainings to sector-specific ones. This reflects not only an increasing demand for ADS in specific domains, but also a change in the scope of the published open calls. The DIGITAL

programme appears to pursue the development of market-ready talent that combine ADS and domain expertise; a recommendation already put forward by the preceding project, LEADS.³

Figure 9. Course breakdown by sector



Most of the in person or hybrid trainings are delivered in France, followed by Ukraine, Finland, Italy, Spain and Portugal (Figure 10). Overall, although the projects portfolio provides trainings across the EU-27 and beyond, in person programmes and courses are less common in Eastern Europe.

Figure 10. Courses hosted by country

Country	No of courses	Country	No of courses
France	116	Cyprus	8
Ukraine	34	Iceland, Ireland	7
Finland, Italy	26	Czechia, Hungary	6
Spain	16	Greece, Sweden	5
Portugal	15	Netherlands, Slovakia	4
Lithuania	14	Estonia, Romania	3
Austria, Denmark	11	Latvia	2
Belgium	10	Croatia, Israel, Norway, Poland	1
Germany	9		

3.3 Key findings of quantitative data

The analysis of the ADS projects portfolio reveals a strong emphasis on short-term, flexible training formats, with nearly 90% of courses designed to be completed in under 500 hours and 66% delivered exclusively online - an approach that caters to the growing demand for modular, accessible learning,

³ <https://zenodo.org/records/14725001>

particularly among SMEs and working professionals. The majority of offerings focus on general ADS, Big Data, AI and Security, with a notable share targeting specific sectors such as Business, Transport and Cybersecurity. Cybersecurity can be viewed from different perspectives: it is a cross-cutting theme relevant across multiple sectors, making it a core technological area within ADS, but it also functions as a vertical domain that encompasses ADS linked to specific technologies, such as AI and Big Data.

Since 2021, there has been a subtle transition from more general training programmes to those tailored to specific sectors, due to a growing demand for ADS within particular domains and an evolution in the focus of published open calls. As such and moving forward, we expect these ADS projects portfolio to contribute to more market-ready talent that blends advanced digital expertise with deep domain knowledge. While the portfolio demonstrates wide geographical coverage, in-person and hybrid trainings are concentrated in countries like France, Ukraine, Finland and Italy, with fewer options available in Eastern Europe.

Most of these differences in the approach and implementation of ADS training by the funded actions can be traced down to:

- Considerations of the real demand as identified in the early stages of the projects.
- Feedback received or lessons learned by own implementation of a certain approach, e.g. through industry engagement.
- Feedback received or lessons learned from previously funded projects, as shared in cluster-wide meetings or the LEADSx2030 (previously LEADS) best practice repository.⁴
- Direct mandates of the European Commission integrated into the open call text.
- Emerging trends and opportunities, such as the growth of micro credentials.

As explored in Section 4, these differences give rise to distinct challenges and opportunities for each project, depending on the maturity, format, content, target audience, and objectives of their training programmes - insights that were clearly echoed in our qualitative analysis and interviews with project coordinators.

Further insights and clearer interrelations from the quantitative analysis will be provided in the next version of this report (D2.4) in May 2026.

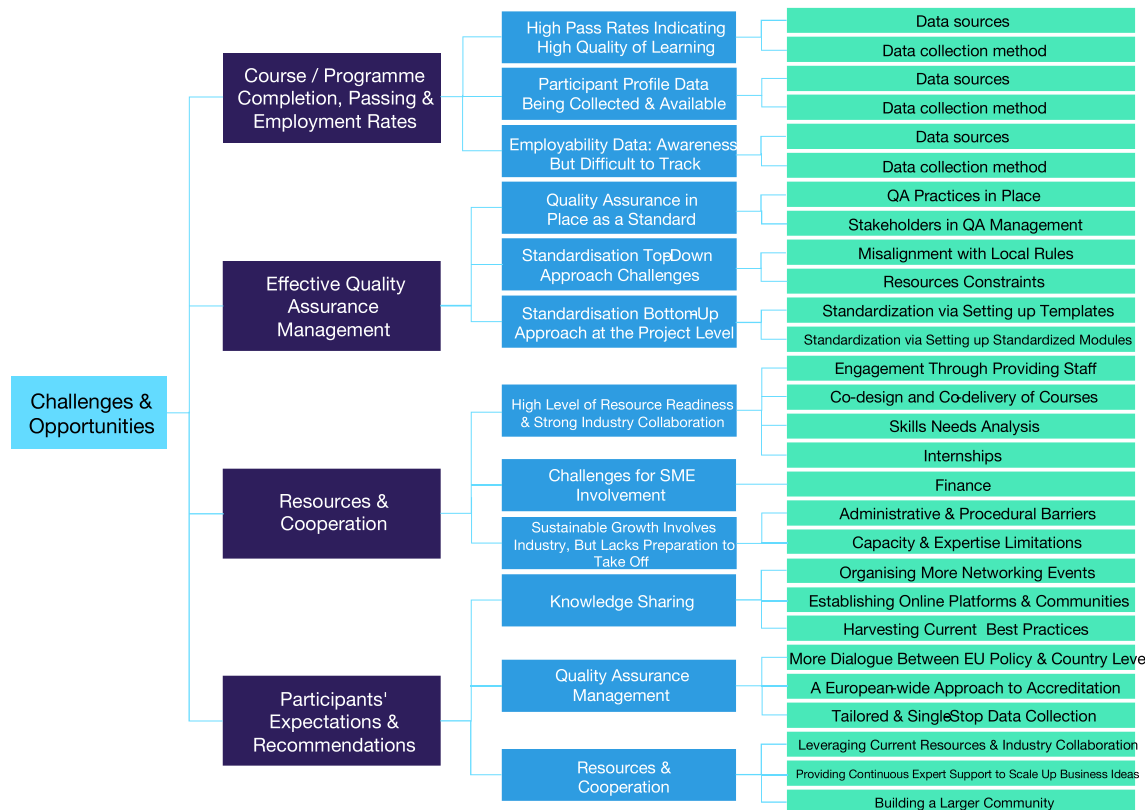
⁴ <https://advancedskills.eu/best-practice-repository/>

4 Challenges and Opportunities in Programme and Project Management

4.1 Introduction

This section presents a synthesis of findings from interviews conducted with leads and coordinators of EU-funded education and training initiatives under the LEADSx2030 programme. Drawing on the thematic analysis, four themes emerged from the data (shown in Figure 11), including how projects are tracking learning outcomes, assuring quality, mobilising resources, and planning for sustainability. While many projects demonstrate strong engagement, high completion rates, and effective industry collaboration, challenges remain in areas such as long-term impact tracking, accreditation alignment, and business model development. The aim of this section is to provide the key findings on the common patterns, highlight emerging practices, and offer grounded recommendations to inform future policy and programme design.

Figure 11. Coding Framework of Qualitative Analysis



4.2 Main theme 1: Course/programme completion, passing & employment rates

The first theme of the findings focusses on how projects approach the conceptualisation and measurement of learning success and achievement of outcomes. Three major dimensions emerge

from the interviews: pass rates, demographic data collection, and employability outcomes. While many project teams are enthusiastic about the positive short-term indicators of learning success such as high completion rates, most reported challenges in gathering robust long-term impact data, especially on employment outcomes. This gap underscores the need for more intentional design around impact and outcome monitoring from the outset.

4.2.1 High pass rates indicating high quality of learning

Across most projects, short-term programmes reported strong pass rates. These were often interpreted by project teams as indicators of successful teaching delivery and participant satisfaction. However, the concept of “pass rate” was not standardised. In some cases, ‘passing’ was conceptualised as completing the course or not dropping out. For longer or accredited programmes, the metric included formal assessment completion and the achievement of pass grades.

This variation in conceptualisation and definition is important: while all teams celebrated persistent engagement and low dropout rates, these figures do not necessarily reflect skill acquisition or deeper learning. Nevertheless, the prevalence of this approach does suggest that short-term training recognises the importance of meeting learners where they are, offering value in accessible formats. The findings below show what data has been collected and how.

4.2.1.1 Data sources

Projects generally tracked attendance, completion, and in some cases, satisfaction surveys. A few included informal learner feedback, which they interpreted as a proxy for pass rate quality shown as below.

*“We have **a pre and post assessment** methodology in order to keep track of the **overall learning experience**, and in general, we let's say, observed an increase in knowledge with respect to making the comparison before and after the training. We distributed a **satisfaction survey** in order to get feedback, not only with respect to the course itself, but also with respect to the overall experience.” (P12)*

*“The criteria for completing the course have mainly to do either with **making some exercises or some tasks** that the teachers are giving or **attending a certain amount of lectures**.” (P16)*

*“In terms of completion, we have agreed to measure that they complete at least, they attend at least the **80% of the learning hours**.” (P17)*

4.2.1.2 Data collection method

Data was typically gathered via course management systems, attendance logs, or through issuance of certificates. There was limited automation, and collection processes often varied between partners within a consortium, as shown in the following quotes.

*“We have maybe **a completion certificate**, but only specific cases, we may have really **an examination**, or something like that. Sometimes we have some kind of hackathon thing which can be **a competition**.” (P2)*

*"What we do in most of the cases is to check the completion and the level of completion, for example, **through the digital paths**. So for a programming workshop with python, we **check the path and the notebook** where they have completed the exercises." (P13)*

*"After the completion of its lesson, the participant is requested to fill in a quiz. After **bypassing the quiz** and all quizzes for all lessons he can have, **the platform generates a certificate**." (P14)*

4.2.2 Participant profile data being collected and available

Most projects collected demographic data at the point of enrolment. Teams were aware of the importance of gathering this information to align with EDI (equity, diversity, and inclusion) objectives and to assess the reach of their programmes. However, there was a strong sense that this data was not always used purposefully.

As one participant noted, *"We collect gender, but we don't use it for anything meaningful"*. The missed opportunity here lies in not connecting demographic trends to programme design, outreach, or inclusion goals. The team reflected on how data use could be more strategic, for instance, using demographic insights to target underrepresented groups.

4.2.2.1 Data sources

Data commonly included gender, age, educational background, and employment status at entry. Some collected more detailed geographic or sectoral information as below.

*"We have **all the details** about our student, their **nationality**, their **sex**, their **background information**, if they are getting **scholarship**, or some, if I may say help from the crews here." (P1)*

*"We collect data that is the **basic demographic data** like **gender, age, nationality**. Also, we have all the data on the **country of residence**, and then we have all the information related to the **academic background**. Also, we ask them about **professional experience**." (P5)*

*"We probably collect in the future, mainly **nationality, gender, profession, current location, current role, position** and why did you apply to master programme, how did you hear about us." (P8)*

4.2.2.2 Data collection method

Typically gathered through pre-course registration forms or institutional enrolment systems. Few used ongoing surveys or post-course follow-ups to update this data as illustrated below:

*"When we launch every edition of the master, we have **a form that must be completed** with a lot of requirements." (P3)*

*"We have been collecting information because there's **a registration process**. When people register, they do mention and we've done with that, we did our own analysis." (P8)*

*"They need to fill in this **registration questionnaire**, where we ask for more information about the background."* (P12)

4.2.3 Employability data: Awareness, but difficult to track

Employability outcomes proved the most challenging area for data collection. Most project teams acknowledged that they did not know what happened to learners after course completion. In some cases, this was because the course itself had not yet finished. However, even in cases where the course had finished, systematic tracking was rare. A few could point to anecdotal evidence or informal success stories.

That said, the discussion itself triggered reflection among project leads. Many remarked that being asked about employability prompted them to think about integrating follow-up data collection mechanisms. Some projects began using newsletters or alumni contact lists as a starting point for ongoing engagement.

4.2.3.1 Data sources

Some projects attempted to gather feedback on skill use or job relevance shortly after programme completion. Data on job changes, promotions, or sectoral movement was mostly absent as followed.

*"About employment, the students that graduated are employed immediately. So we know that they were all employed, but we **didn't have surveys about that**. It's just the personal information that we know because we know them very well."* (P10)

*"About the employment situation, that has been **a huge challenge**, we have **very low response rate**. None of them have reported change in the employment situation, however, and something that I would like to see in that very reduced response rate that we have had this information about **other type of impact**, so **development of tools, publication of papers, publication of thesis**."* (P13)

*"The feedback we have received hasn't been really about somebody finding work as such, but that they were happy that they built a network when they participated in the courses so that they see now that they have **a better prospect of finding work**."* (P16)

4.2.3.2 Data collection method

Where it existed, employability data came through informal alumni tracking, newsletters, or anecdotal reports from partner organisations as shown below.

*"They are part of **our alumni**, and we are very in contact with them."* (P3)

*"We decided our **alumni community** will be based on **LinkedIn profiles**. The employment rate you will be analysing, probably through LinkedIn, and after the graduation, after six months, **some survey** will be done just to gather the information as well."* (P6)

*"And then, six months after the students have completed these courses, we'd be **following up with a survey** seeking more detailed information."* (P15)

Further information about Course/Programme Completion, Passing & Employment Rates within the project is presented in Annex B.

4.3 Main theme 2: Effective quality assurance management

Quality assurance (QA) was one of the most discussed topics during the interviews. While QA processes are widely in place, their form and function vary across contexts. A clear tension emerged between the EU's push for standardised QA and the realities of national and institutional constraints. This section also shows how projects creatively navigate these tensions by developing their own internal practices.

4.3.1 Quality assurance in place as a standard

Most project leads reported that QA systems were functioning well, particularly at the module or course level. These systems were often inherited from the lead institution's normal practices. Module evaluations, student feedback, and expert panels were commonly used.

However, QA at the programme level was less developed, particularly in short-term training contexts. Some teams admitted that QA practices were more performative than developmental, reflecting compliance rather than genuine quality improvement.

4.3.1.1 QA practices in place

Common practices included module evaluations, expert advisory groups, peer review processes, and continuous feedback loops as followed.

*"We are doing **a full set of the quality assurance** specifically for this programme, so these monitoring and evaluation work package runs from day one to the project to the last month and they are producing reports. So it's not only about **the students**, but it's also, for instance, **regular interviews with the partners**, producing collecting information from our administration systems." (P5)*

*"What we plan to do is to include members of the consortium or potential people going to talk about the industry, **Industry Advisory Board** to join the lessons and provide their own input **as a form of peer review** on the actual delivery. We had **an internal trial** for which we used as participants, members of the consortia. As members of the consortium, we can consider where we introduce **a public trial** as a form of quality assurance of the delivery and the content itself." (P8)*

*"So the universities usually already had programs accredited, and they just did **an upgrade of their curriculum**. We also **measure the quality with the universities**, with the process of quality from the universities, and with the specific task, involving also **feedbacks from the students**." (P11)*

4.3.1.2 Stakeholders in QA management

Faculty members, course coordinators, and in some cases, industry experts. Short-term programmes often involved external advisors for iterative reviews, explained as below.

*"In our case, **study programme committee** has a department. This department has faculty, faculty has study division, and the Senate, so there is at least 4 steps which we are going through. So this study programme committee usually is responsible for looking after the quality." (P6)*

*"There is indeed **a quality assurance team** currently, it's mostly looking at deliverables. The quality assurance thing for content development is mostly comprised of **industry partners, the academic partners and the content developers.**" (P8)*

*"There is **an editorial board made by expert** in assessing training material, which, of course, is this board that are not members of the partners that developed the training materials. **External expertise**, let's say, represented also officially in the project, in the form of the **Advisory Board members.**" (P17)*

4.3.2 Standardisation top-down approach challenges

The interviews revealed deep frustration with the practical limitations of EU-level QA frameworks such as the European Approach to the Accreditation of Joint Programmes ([European Approach for Quality Assurance of Joint Programmes](#)). While these policies are intended to simplify cross-border accreditation, they often clash with entrenched national systems. Several interviewees described local accreditation authorities or university leaders as blocking attempts to use EU-standardised templates.

In many cases, projects had the will to align with EU approaches designed to facilitate joint programme accreditation but lacked the authority or leverage to do so. This created inefficiencies and sometimes led to delays in programme rollout as well as individualised implementation timelines for each institution.

4.3.2.1 Misalignment with local rules

National accreditation processes were consistently described as "immovable," with local governance structures holding more power than EU recommendations. Teams found it difficult to navigate conflicting requirements when national authorities refused to recognise EU-standardised approaches as shown in the following quotes.

*"So **all four universities had completely different procedure**, like how it goes, and because in the project we had some kind of analysis, how it's done and so on. All the universities have some kind of a division called Study Programme Committee, so this committee is responsible for the study programme like the first step, because usually **there is some kind of a hierarchical structure.**" (P6)*

*"We went to **two different accreditation process**, because **Italy has not integrated yet the European approach.** So we had to go through the Italy accreditation process, and after that we had to go to the European approach. So when we went to the Italian accreditation process, it was directly approved, and we were **quite stressed**, because **if we did not pass the European approach, then we will have had to postpone it for two years.**" (P7)*

*"We **had to make it happen to be independent** because that the point is it would have been great to have this as one joint thing, everybody does exactly the same. **The problem is local laws and regulations hinder us** to do this and also **the administrative part.** So we have implemented this independently every university for themselves. So **alignment between European countries alignment is pretty hard.**" (P9)*

4.3.2.2 Resources constraints

Resource limitations made it particularly challenging for teams to duplicate efforts to meet both EU and national standards simultaneously. Projects struggled to allocate sufficient time and funding to satisfy multiple, often contradictory, accreditation requirements across different jurisdictions shown as below.

*“National accreditations agencies are not yet prepared for this [online delivery]. So, they have a lot of questions on why so that number of synchronous sessions, why so that huge number of asynchronous online session, how we would follow up the students, etc. The **process is not that streamlined**, so you can always apply for an accreditation, but you don't know exactly when you get the results. That's a problem.” (P5)*

*“We are aiming to have one way of doing, the master is going to be an online master programme. However, **not all academic partners, because of national legislations, are able to deliver online master programs**. You need to **very well know what national constraints are**, not only three layers, so they are European, national, and then let's say, local institution level.” (P8)*

*“Like all the European funded projects, **the level of formality and bureaucracy**, even in a positive way, **is very high**. And this is something, an aspect that I mean, we need to **dedicate a lot of effort to make the project advance**, basically to reach all the results. So, this is **a challenge**, because what I want to say is that they are very complicated projects and they **require a lot of effort** from the coordinators and the partners to **satisfy all the rules and implement all the actions that are foreseen**.” (P11)*

4.3.3 Standardisation bottom-up approach at the project level

In contrast to the top-down constraints, many projects developed internal templates and QA systems that worked across their consortia. This peer-driven approach to standardisation proved to be both feasible and valuable.

Teams described how they co-designed shared learning outcomes, created joint assessment frameworks, and exchanged best practices across institutions. These internal innovations allowed them to maintain quality even in the face of external bureaucratic barriers.

4.3.3.1 Standardisation via setting up templates

Projects developed shared quality assurance templates for consistent use across partner institutions. Teams collaborated to align module objectives and assessments, while advisory boards provided feedback to iteratively improve short-term programs demonstrated as below.

*“In terms of to ensure consistency, of course, we **developed a specific template** for preparing the presentation and also to ensure to have a common way to report and to visualize the information.” (P12)*

*“We have **evaluation sessions**, and again, we have made **a form**, and we fill in this and we ask them in general about, how was the interaction with the participants? What was their feeling? How did they actually engage? Did they learn? Did they ask questions?” (P16)*

*"It starts a first iteration, following a template with some criteria which are known beforehand and then the comments are, and then, for each course generally there are **three reviewers filling in this template** according to this criteria very precise, because they go even at single slide level, at course level, but also at single slide level. We're also filling in a template, which is a sort of change request to be implemented."* (P17)

4.3.3.2 Standardisation via setting up standardised modules

Some projects created fully standardised module documentation for implementation across different institutional contexts. This involved developing shared QA frameworks while allowing for local adaptation. Advisory boards provided regular input to enhance these standardised offerings over time as explained below.

*"What we are trying to do to solve and to avoid having this gap is **creating one unique centralised coordination serving quality assurance strategy**."* (P7)

*"We have a **joint programme learning objectives defined** and so on so first, which are then reflected in the **individual design of the programs of the specialisation directions**. What we also have of course, is that we have these regular meetings and talk about the stuff. So we **have this steering board implemented**."* (P9)

*"We had also project courses that we saw that the local needs do not coincide so much. So, they should **have general objectives**, but **the local objectives or the focus would be different in its country**."* (P16)

Annex C details further information of Effective Quality Assurance Management within the above established themes.

4.4 Main theme 3: Resources and cooperation

Projects varied significantly in terms of resource stability and organisational capacity. University-based teams benefited from established structural support and staffing stability, while Small and Medium Enterprises (SMEs) faced considerably greater challenges in maintaining consistent participation. Industry collaboration emerged as a strong asset across most projects, with high levels of engagement in both co-design and delivery phases, but sustainability planning remained consistently weak across the board.

4.4.1 High level of resource readiness & strong industry collaboration

4.4.1.1 Engagement through providing staff

Universities consistently contributed stable teaching and administrative staff to project consortia, drawing on their established human resource infrastructure and institutional continuity. In contrast, SMEs proved more vulnerable to staff turnover and experienced significant staffing gaps that sometimes disrupted project timelines and deliverables, as shown below.

*"So it's basically it's **recruiting within the partners**. And we **haven't done much recruiting from outside**."* (P2)

*“So the **staffing of the master project is not a problem**, we have a lot of very knowledgeable people in the project. And **for the future we will train a lot of younger staff.**” (P10)*

*“There is a sort of co-investment happening even for the teaching staff **from university and from the industry**. And this is most of the time **not a huge problem for universities**, it's **more difficult, especially for industrial partners**, which are not big partners, big corporates, **SMEs or startups** for them.” (P11)*

4.4.1.2 Co-design and co-delivery of courses

Industry partners demonstrated deep involvement in shaping course content, bringing real-world expertise and market insights to curriculum development. In many cases, these partners went beyond advisory roles to actively deliver portions of the training, creating authentic learning experiences that bridged academic theory with practical application, explained as below.

*“Since we kick off the project, the professors in all the universities, together with SMEs and the research centre, they were just working really massively in **creating the content, creating the consortium agreement** for the programme and also **the preparation for the accreditation**. We've been lucky also with **the industry based teaching staff**, because, the programme itself has inside the programme **mandatory seminars from industry.**” (P7)*

*“On a very top level, we have **an executive board** that consists of industry partner and **external advisory policy** that consists of industry partners, and they give us feedback on that. Then three industry partners that are **the joint associates**, so there's the **collaboration stronger** and they also will help us in future when we want to provide **master thesis** and stuff like this.” (P9)*

*“We had **collaboration in designing the trainings**, so receiving needs and find out what we can best give them. We have had **collaboration in delivery**. The list was that they can provide us with **some use case** that can be used in the in the course. There is also a couple of courses where there was **a part of the course was delivered by an SME.**” (P16)*

4.4.1.3 Skills needs analysis

Industry input proved crucial in helping projects align course content with rapidly evolving market demands. This collaboration was particularly valuable in developing short-term training modules that needed to respond quickly to emerging skills gaps and technological changes in various sectors, which is illustrated as below.

*“We started, in fact, with **a very strong industry involvement for carrying out skills need analysis**. That was the basis of the design of our programme. And that was the first moment that the industry come together with us to discuss, we collect information, and then we gave back to them **in a webinar the results of the skills need analysis** and we took them in consideration for designing the programme.” (P5)*

*"We had industry partners, we were consulting also when we were developing the study programme. So we have **meetings with those to estimate what are the needs, what are the skills** and what we do also." (P6)*

*"In terms of getting input from industry, our project very much drew on engagement with industry to inform the courses. So part of the project involved **a survey**, and we had one for employees, and we had one for managers and leaders. So the courses we provide very much drew on that data and that's **the skills mapping tool**." (P15)*

4.4.1.4 Internships

Many projects successfully facilitated internships and real-world project opportunities through their partner companies. These placements enhanced the employability relevance of training programs by providing participants with hands-on experience and direct connections to potential employers as shown below.

*"So the budget for financial support to third parties is going to be used to give students the possibility to **have internships in this industry partners**, which in server action is actually one of the deliverables, is creating a solid basic document for allowing more industry partner to become part of the master programme." (P7)*

*"The student itself could choose to go into **an internship**, either with **a partner within the consortium**, a partner company, or **some other company that's well connected to one of the academic partners**, or maybe there are some of the industry partners." (P8)*

*"The idea is that in the second year of the master, there will be **all kinds of internships** and they will be **delivered partially by the SMEs** and by **a wider ecosystem of industry partners**." (P10)*

4.4.2 Challenges for SME involvement (finance)

Many SMEs struggled significantly to meet the required co-financing contributions, which typically demanded substantial in-kind resource commitments. This financial burden limited their ability to participate meaningfully in projects or maintain consistent commitment throughout the entire project lifecycle, often forcing them to reduce their involvement over time as explained below.

*"**With 50-50, that doesn't work...** So this partner, there's one partner that stayed actually the other one simply left and said, it doesn't work out for us, so **they left even before the project started**." (P2)*

*"One potential difficulty is on the finance and the co-financing part. It's **more difficult**, especially for industrial partners, which are not big partners, big corporates, **SMEs or startups for them**. It's more difficult to participate in this project because they need to co-finance 50% of their effort." (P11)*

*"There have been several admin offices that have **had some doubts and some resistance to implementing co-funding**, because it's just so much administrative work, so much more than for the fully funded projects." (P13)*

4.4.3 Sustainable growth involves industry, but lacks preparation to take off

While projects demonstrated strong industry engagement and collaboration throughout their implementation phases, they consistently struggled to translate this momentum into viable post-funding sustainability plans. The combination of procedural constraints and capacity limitations created a gap between successful project delivery and long-term viability. This paradox of strong collaborative foundations paired with weak transition planning emerged as a critical challenge across multiple project contexts.

4.4.3.1 Administrative and procedural barriers

Time-consuming administrative processes and accreditation delays significantly constrained projects' ability to focus on sustainability planning. The extensive requirements for compliance, reporting, and quality assurance consumed substantial portions of available project timelines, leaving teams with limited capacity to develop comprehensive strategies for post-funding operations. These procedural demands often pushed sustainability considerations to the margins of project management priorities shown as below.

*"We're considering whether actually to **ask for an extension**, maybe to certain things up easier. We don't know yet whether that will work out. We're **making the plans** for that at the moment actually. It's not super long, just a few months. So this is very some of these start issues." (P2)*

*"It was less challenging than **accrediting** a new master, of course, but **this process took roughly**, I would say **6-10 months of the project**. So there was some formal step to change the curriculum within the accredited master, and this was, I mean, not a super long, but yet **not an immediate task** that we dedicate mostly the first part of the project." (P11)*

*"The overall process took a while. We had **an a slight impact on the delay**. Maybe we had to **postpone or delay some activities**... It's a **challenging**, you know, because I believe that you'd be **busy with all the projects**, the whole project, and then finally say, okay, **we're going to finish**. What's next?" (P12)*

4.4.3.2 Capacity and expertise limitations

Most project teams lacked essential business and financial expertise required for effective sustainability planning. Few consortia included specialists with experience in developing robust business models, pricing strategies, or organisational transition plans. This expertise gap prevented teams from creating viable pathways for continued operation beyond the funded period, despite having established strong educational content and industry partnerships during the project phase demonstrated as below.

*"We **cannot enumerate the numerous things we bumped into**, basically because there are so many conflicting regulations, national regulation that you need to go to the European, and it's very complicated so the setting up the entire thing." (P8)*

*“you know how economy changes and **we don't know what is in ten years**. At the end, the programme will not only die **if we don't find financing for chip** for the table, the people are still there that the project is still there things can still be done, just the table cannot be done, which **would be a shame but would not kill the programme completely**.” (P9)*

*“Actually, we are exactly at the starting of that discussion in the consortium. We have **prepared a sustainability strategy plan** that was one of the deliverables of the project. It's the first document. It's a first document it sets, I think it **puts more questions than it gives us answers**.” (P5)*

Additional quotes about Resources and Cooperation practices are presented in Annex D.

4.5 Main theme 4: Participants' expectations & recommendations

Participants voiced a clear and consistent desire for improved networking opportunities, enhanced knowledge sharing mechanisms, and sustained institutional support. Their reflections revealed an appetite not merely for increased funding, but for fundamentally smarter systems of collaboration, continuity, and collective learning that could build on existing achievements. The recommendations that emerged from interviews clustered around three focal themes: knowledge sharing, quality assurance, and long-term cooperation.

4.5.1 Knowledge sharing

4.5.1.1 Organising more networking events

Participants consistently called for structured opportunities to connect with similar projects, particularly during early implementation stages. They envisioned thematic clusters that would group projects by sector or methodology, as well as regional groups that could facilitate face-to-face collaboration and shared problem-solving as followed.

*“it would have been, let's say, good to **create synergies with this similar projects since the very beginning**, because some tasks were the same, and maybe with **the joint effort** we could have **reached more people together**. And this is for sure, something that I would take into consideration as a lesson learned for next projects.” (P12)*

*“It's nice that now we have **more instances to interact**. At the beginning of the project, it was just sending reports through the portal interaction we had. So that has made us **feel more connected to like a sort of community**.” (P13)*

*“I am really grateful to you actually for coordinating this because we have been asking this from the project officer from the moment we had just before we signed the grand agreement that there should be some kind of **coordinated activity between the projects** because we knew that it can be that the challenges we have, we are the only ones and it is useful to see what the others are doing and **exchange ideas and support each other**.” (P16)*

4.5.1.2 Establishing online knowledge sharing platforms and communities

Beyond simple file repositories, participants expressed strong interest in dynamic, interactive platforms that would support ongoing collaboration. They specifically mentioned forums for real-time discussion, AI-enabled tools for intelligent search and recommendation, and dedicated spaces for sharing templates, troubleshooting common problems, and seeking advice from experienced practitioners, which is demonstrated as below.

“Portals for budget, AI guide to template completion with live questioning too, it’s difficult to get information you need when completing these documents. Portal for internships to help manage these details and issue standard agreements.” (P4)

“In all the projects we develop platforms on platforms, and it would be great if we could have a kind of a common environment, maybe provided by the European Commission, where we can upload and really share all the results that would be then sustained by the European Commission itself. And also to avoid this really fragmentation of results of information platforms and overall. And it’s always a never-ending discussion on this, and this is my suggestion, my hope.” (P12)

“I know we have the meetings, but I don’t know if it’s possible to have some kind of chat or mailing list, share things, or like a blog, or like a place to post questions, and that people can reply to them... you’re so like into the bubble of your own project that it can be that the solution is out there. I know you have the best practices repository... I think, having a more casual place for interaction, be really great, also in a way that doesn’t require a meeting, because everybody is busy and scheduling. A meeting is super difficult, so I imagine this blog post when you can just share your questions and maybe tag people, that would be fantastic.” (P13)

4.5.1.3 Harvesting current best practices

Teams recommended establishing systematic processes for collecting and curating existing tools, processes, and success stories into a comprehensive, searchable EU knowledge base. This would prevent the repeated reinvention of solutions and allow new projects to build on proven approaches shown as below.

“Define what your target group is, write it in stone. It’s of course, maybe not that in stone have some room for flexibility, but at least everyone should know from the very start, what is going to be your target group... So know what are different constraints, and then choose your partners carefully, making sure that they are all on the same page, and you are well aware of the constraints that come with content delivery, with accreditation, all that kind of stuff.” (P8)

“There’s no way to exclude some person who has the necessary technical background from a study direction and that makes it challenging in that way because we need to offer them an alternative path. What we’ll do for them, we open a second path with another technology, which is open source, and that of course increases a lot the effort we have to implement stuff.” (P9)

*"We would like to recommend **the robustness of our methodology**, because it's based really on learning outcomes formulated according to the Bloom's taxonomy. One of the biggest achievements, maybe the biggest in this project so far, is this exactly fact that, according to the very **well-defined procedure and design** of the training offer using the **learning outcome approach**. We are fully aligned with the key EC policies in terms of training, instructional design, so training design, and certification of the achievement of the learning outcomes."* (P17)

4.5.2 Quality assurance management

4.5.2.1 More dialogues between EU policy and country level

Projects consistently recommended improved coordination between European policy frameworks and national accreditation bodies. This dialogue was seen as particularly crucial for facilitating cross-border programme delivery and ensuring that EU-level initiatives could be practically implemented within existing national regulatory frameworks, shown as below.

*"It seems that for Germany, it would also be very difficult because of **the autonomy of the regions** so that would be something that maybe **member states need to reflect and the agencies and the commission should reflect** to understand better how they could help the project."* (P5)

*"It's **challenging to work with so many partners**, that is difficult also all bureaucratic part of running a project this big so people have, you ask a lot from people. Also **this fear that they have for the bureaucracy of the EU** that is also something that **sets us back**. So they **take the grant agreement very literally**. And then when we say, Well, but there's flexibility, I mean, this is project, project is always different than what you wrote in the proposal, and then they don't believe this."* (P10)

4.5.2.2A European-wide approach to accreditation

While acknowledging that European accreditation frameworks already exist, participants called for making these systems more actionable and deeply embedded in practice. They suggested developing flexible pathways for recognition and modular approaches that could adapt to different national contexts while maintaining European standards, illustrated as below.

*"I would like to make this recommendation at this level, at the level also of policies that are needed from the European Union side or systems to help us as project, as universities to overcome some of these issues. So we need to **dig in on pilot experience using this European approach** and see **whether this is really the way to go in these projects for all EU member states** and now I would add that challenges does this work for all EU member states because, for instance, it seems that **for France it doesn't work**."* (P5)

*"It's **interdisciplinary**, which was a challenge. **Many countries don't recognise interdisciplinary education**... if a university in Europe in one country does not recognise the system in another country, we cannot do anything about it. That this national law, it simply doesn't work. So we **struggle with European and national laws**."* (P10)

4.5.2.3 Tailored and single-stop data collection

Participants strongly advocated for a unified framework for collecting learner outcomes and quality assurance data. Such a system would reduce the current duplication of effort required to satisfy multiple reporting requirements while supporting meaningful cross-project comparability and evaluation, demonstrated as below.

*“That is a message that we would like to send to the Commission as a challenge, especially when **we have all of these micro things, asking for full statistics**, that is basically **reducing our outreach**. Just it's a lot of effort.” (P2)*

*“One issue which I faced was **not clear presentation of what kind of a data we will need to report** to European Commission because in the beginning it was like, Okay, those KPIs which we promised the deliverables milestones. Then they added like, Oh, no, you need to do the survey every 6 months. And even now, when we are asking, and he was like, Oh, you should provide this information and that information. So I understood it was on the go, so there was **some kind of a confusion**.” (P6)*

*“I would really like to see **a wider view on the KPIs**. Of course I understand that it's employability, the main target, but given the low response rate, and the **employability might follow as a very long term impact**, the project might not even be on then, and I think **other valuable impact** could be captured through the KPIs.” (P13)*

4.5.3 Resources and cooperation

4.5.3.1 Leveraging current resources and industry collaboration

Partners expressed desire for formal mechanisms to sustain successful collaborations beyond individual project cycles. They envisioned structures such as joint ventures, co-branded certification programs, or consortium agreements that could maintain productive relationships and continue developing innovative training solutions explained as followed.

*“The most important point was **the collaboration and the good cooperation of the partners within the project**, because nothing can be done alone. If you don't have a good and collaborative partners, it's impossible to go to go ahead and proceed with a European project, especially when here are the challenges for sure to avoid.” (P12)*

*“We're considering **enhancing somehow the certification**, accreditation method of our offer. We are in a **communication with a certified organisations** that provide official certification in order to enhance and maybe promote the training offer to remain and people can still participate.” (P14)*

*“just that **interaction** with people working with industry, in addition to our survey, which is still live, and which informed the phase, one of our courses, but that **ongoing engagement with industry**, I think, is important.” (P15)*

4.5.3.2 Providing continuous expert support to scale up business ideas

There was strong and consistent demand for ongoing guidance in business model development, pricing strategies, and post-funding transition planning. Participants recognised that technical

expertise in education delivery needed to be complemented by commercial acumen to ensure programme sustainability, demonstrated as below.

*"We cannot attract **students from outside the European Union**, and it seems that this master can be very attractive, we are getting a lot of inquiries from students that are **non-EU nationals** ... So why not we could attract and be a kind of would say **European based offer** for the world on digital health?" (P5)*

*"I think, **digital jobs platform**, it is good, but it's not so good. The idea is really good, but the **real implementation is not so good**... I think we need to find a way to make it **more aim to students and candidates** rather than people involved in in the projects already." (P7)*

*"The **professional trainings**, I think they have the potential of becoming sustainable by just **making them commercial**. So I think, but we **have not yet enough data** to say that for some of our partners, SMEs can **deliver these courses commercially**. Some of them and some courses we have still to wait how many people are prepared to **pay a reasonable price** for it in the future when it's not for free anymore." (P10)*

4.5.3 Building a larger community for maintaining relationships and collaboration

Rather than starting fresh with new partnerships in each funding cycle, participants strongly favoured building enduring communities of practice. These would be anchored in mutual trust, deep knowledge of each other's institutional contexts and capabilities, and shared commitment to continuous improvement and innovation in education and training, illustrated as below.

*"Why not to **enlarge these two other universities in Europe** you know. Then there is a sideline that is maybe we also would like to discuss for applying to new opportunities for instance **these Skills academies** is something that is we do get in touch or so." (P5)*

*"So they started with three and then the others will probably join in the second year. But no, I noticed that this **idea of European University** is very attractive for universities especially for some countries, it's very attractive." (P10)*

*"with networking partners in the other countries so that I mean also this **cross country collaboration** will not cease. I think that it has been also quite **motivational** for companies and people to engage the fact that there are these **international collaborations**. So I would have liked to see more courses being implemented in collaboration." (P16)*

Annex E provides additional information of Expectations and Recommendations that teams made.

4.6 Key findings of qualitative data

This qualitative analysis presents key insights from interviews with coordinators of EU-funded education and training projects under the LEADSx2030 programme. Four major themes emerged:

- **Programme completion & employability:** While most projects reported high short-term pass rates, definitions varied and did not always reflect deep learning or skill acquisition. Demographic data was routinely collected but underutilised. Tracking long-term employability outcomes proved challenging, with few mechanisms in place beyond anecdotal feedback.
- **Quality Assurance (QA):** QA processes were generally strong at the module level but less consistent across entire programmes. EU-level QA frameworks often clashed with national accreditation systems, causing implementation delays. In response, many projects developed internal QA templates and collaborative tools to maintain standards across partners.
- **Resources & industry collaboration:** Universities provided stable staff and infrastructure, while industry partners contributed significantly to course design and delivery. However, small and medium-sized enterprises (SMEs) faced participation barriers due to limited resources and co-financing requirements. Despite strong implementation, sustainability planning beyond project funding remained a significant gap.
- **Recommendations from Participants:** Teams highlighted the need for enhanced networking, better knowledge-sharing platforms, streamlined QA and data systems, and stronger alignment between EU and national frameworks. Sustained collaboration and business expertise were seen as essential for long-term programme impact and scalability.

These findings reveal a strong commitment to quality and collaboration across projects, yet also point to systemic constraints that hinder long-term impact. This underscores the need for more coordinated systems, sustainable practices, and supportive policy alignment. The following section offers targeted recommendations to address these gaps and build on the promising foundations already in place.

5 Recommendations

The data analysis from ADS Annual Report Year 1 (D2.3) reveals a strong start, with 465 training courses launched across 32 EU-funded projects, tailored to multiple areas in ADS like AI, Big Data, and Cybersecurity. While completion rates and participant satisfaction are high, and collaboration between partners is strong, several challenges persist in employability tracking, cross-border accreditation, SME participation, and sustainability planning. Below are the recommendations from the team to help address these constraints and to improve delivery, impacts and outcomes of the programme.

- **Strengthen outcome tracking and evaluation mechanisms**

While most training programmes demonstrated high short-term completion and satisfaction rates, there is a systemic gap in long-term outcome tracking – particularly employability, learner progression, and impact on career mobility. A centralised, standardised impact monitoring system should be established across the SO4 ADS Cluster. This system could integrate survey instruments distributed at 6- and 12-month intervals post-course completion and automated LinkedIn analytics to monitor career progression. A shared dashboard would allow benchmarking across programmes and sectors. Project partners could also create mechanisms to gather employer feedback on the relevance and effectiveness of training content in addressing actual skills needs. In addition, maintaining contact with participants through newsletters, communities of practice, or alumni networks would help reinforce continued engagement.

- **Streamline EU-wide accreditation & harmonised Quality Assurance (QA)**

While many quality assurance processes are in place at institutional levels, navigating multiple national accreditation systems remains one of the most significant constraints, especially for cross-border programmes and innovative formats like microcredentials or online delivery. Policymakers and EU Member States must actively facilitate coordination between European and national QA agencies through dedicated working groups or advisory panels. These bodies should explore mutual recognition agreements and develop pathways for co-accreditation of joint programmes, or innovative learning formats. The project partners should also prioritise early alignment on accreditation and QA strategies within consortia. This includes co-developing templates for course documentation, shared learning outcomes, harmonised assessment rubrics, peer review, and programme evaluation to ensure consistency across consortia and streamline accreditation processes.

- **Promote a sustainable funding model with industry partners and early business planning**

Requirements in co-financing and lack of business capacity posed a major barrier to sustainable development and SME participation, risking the very industry involvement needed for job-market alignment. This means that policymakers should revisit co-financing ratios and explore tiered models that are more inclusive of SMEs and start-ups. ADS project coordinators should also provide SMEs with in-kind support mechanisms and clearer value propositions. This could include a financial/legal advisory support function to assist with project budgeting, time/resource planning, and administration, which would help SMEs navigate funding requirements and calculate returns on investment.

In addition, more guidance, mentoring, and tools is needed to help project teams develop long-term business models. This could include financial forecasting tools, pricing strategy

models, stakeholder value mapping, and access to successful scale-up case studies. Education and training providers must incorporate sustainability planning from the project design stage. This involves identifying potential revenue sources such as modular course licensing, continuing education schemes, or employer-sponsored upskilling programmes. Piloting early fee-based versions of short courses could test market viability.

- **Enhance knowledge sharing & collaborative learning across the clusters**

Participants consistently called for more opportunities to learn from one another, share resources, and align efforts – particularly during the early stages of programme development. This could be enhanced by establishing ongoing, structured communities of practice grouped by interested area such as Cybersecurity, AI in healthcare, microcredential design. Another initiative includes a pan-European digital collaboration platform that allows real-time interaction, resource sharing, and troubleshooting. This should include discussion forums, template libraries, case studies with implementation details, and peer-support channels. Project participants should be encouraged to contribute regularly to this platform, with recognition incentives such as visibility in EU reports, co-authorship on best practice publications, and opportunities to present at ADS annual summits. Policymakers should allocate dedicated funding for networking activities – such as regular cross-project workshops, site visits, peer exchange residencies, or virtual innovation labs – foster a stronger ecosystem mindset, encourage collaboration, accelerate innovation and reduce fragmentation among ADS initiatives.

6 Summary

The ADS Annual Report Year 1 (D2.3) presents a comprehensive analysis of 32 DIGITAL SO4 funded actions in the ADS Actions Dataset (D2.2), drawn on the ADS analytical framework (D2.1). This document captures both quantitative and qualitative insights into the evolving landscape of ADS training across Europe. Key findings highlight a strong initial rollout, with over 460 training courses launched – primarily short-term, online, and focused on general ADS, AI, Big data, and Cybersecurity. These flexible formats cater to SMEs and working professionals, but also raise questions about employability outcomes, and long-term learner progression.

Despite high completion rates and strong institutional engagement, several systemic challenges were identified. These include limited mechanisms for tracking post-training employability, persistent barriers in cross-border accreditation, financial constraints affecting SME involvement, and insufficient sustainability planning for continued impact beyond funding cycles. Furthermore, participants expressed a strong need for enhanced networking, peer learning, and real-time collaboration across projects. The Report offers targeted recommendations to address these challenges and encourages a more cohesive, scalable, and impact-driven ecosystem. These insights lay a solid foundation for iterative improvements and more strategic coordination in the years ahead.

References

- ¹ <https://eur-lex.europa.eu/eli/dec/2022/2481/oj>
- ² Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- ³ <https://zenodo.org/records/14725001>
- ⁴ <https://advancedskills.eu/best-practice-repository/>

Annex A. Interview guide

1. Course/programme completion, passing & employment rates

Q1: Can you describe the extent to which you collect demographic information about participants in your courses or programmes? What types of data do you typically gather, and how does this vary across different programmes or courses?

- Overall:
 - Number of participants
 - Gender distribution
 - Pre-programme status
 - Age (median/mean/range)
 - Nationality representation
- Specific per programme/course:
 - Gender distribution
 - Nationality representation

Q2: How would you describe the pass rates for students who have completed your programmes or courses? What factors do you think influence these rates?

Q3: What changes, if any, have you observed in the employment situation of participants after completing your courses or programmes? How do you track these outcomes, and do you notice any trends related to gender or nationality?

2. Quality assurance of courses/programmes

Q4: Can you describe how quality assurance has been managed at the course or programme level, particularly leading up to and during the implementation stage? What key processes or challenges have you encountered?

- Programme design process
- Programme approval process
- Programme committees
- Programme reviews

Q5: How has quality assurance been managed at the course or programme level following implementation? What processes are in place to monitor and improve quality over time?

- Programme evaluations by students
- Module evaluations by students
- Programme oversight by a Director of Teaching & Learning

Q6: Can you describe the role that external bodies play in quality assurance at the course or programme level? How do they assess courses or programmes, and what impact does their evaluation have?

- National and/or Regional accreditations and/or International accreditations
- Assessment frequency
- Evaluation criteria

3. Key points to discuss with coordinator institutions and/or course/programme providers

STAFFING & COOPERATION

Q7: Can you describe the staffing structure for delivering your courses or programmes? How does gender representation vary among academic and industry-based teaching staff?

Q8: What challenges and strategies have you encountered in attracting and retaining both academic and industry-based teaching staff? Have you noticed any gender-related trends in recruitment and retention?

Q9: How would you describe the level of cooperation between your institution and research or industry partners? What factors have influenced the success of these collaborations?

- Number of staff in delivering the course/programme (per gender)
- Feedback on Attracting & retaining academic teaching staff (by gender)
- Feedback on Attracting & retaining teaching staff from industry (by gender)
- Perceived Level of cooperation between higher education provider(s) and research and industry partners

FINANCIAL ISSUES

Q10: Can you share any experiences with financial constraints when designing and delivering your programmes or courses? How have these challenges influenced decision-making and resource allocation?

- Were your estimates accurate?
 - Design (on-/under-/over-budget)
 - Delivery (a profit/loss/break-even)
- Were your programmes/courses financially sustainable?
- What are your funding plans beyond the end of the project?

RECOMMENDATIONS

Q11: What challenges have you encountered in delivering your courses or programmes? How have you addressed these difficulties?

Q12: What key factors have contributed to the successful delivery of your courses or programmes? Are there any best practices or strategies that have worked particularly well?

- Challenges faced:
- Enablers:

Q13: Based on your experience, what best practices and innovative approaches would you recommend for designing and delivering successful courses or programmes? Are there any specific strategies that have been particularly effective?

Q14: Do you have any recommendations for improving the overall LEADSx2030 programme portfolio and/or for policy-makers?

ANY OTHER FEEDBACK

Closing question: Is there anything else you'd like to add that hasn't been mentioned or covered?

Annex B. Additional quotes for the Main Theme 1: Course/Programme completion, passing & employment rates

Theme	Sub-theme	Illustrative Quotes
High pass rates indicating high quality of learning	Data sources	"There's tested they are taking because they have semesters." (P1)
		"Each network defines 'passing' itself, this can include attendance." (P4)
		"This master programme is designed with what they call it in the formal programme documents graduation week, but it is actually a week that is designed for students to defend the master thesis, also to do a final exercise what they call attack defence in cyber security." (P7)
		"What we do in most of the cases is to check the completion and the level of completion." (P13)
	Data collection method	"All students are actually given the chance to retake the quiz and pass, even though they might not pass the first time. We have a percentage of completion within each quiz" (P14)
		"we are actually measuring the time that the participant actually; we measured how many participants attended the actual course ... they had a test to assess the level of participation and the skills that they have actually acquired for the course" (P18)
		"During that final week we will also do kind of a quality assessment procedure, where we want to give the students like a final document like in person, which we think is going to be easier for us to have the data." (P7)
		"We have two different types of certificate, the certificate of attendance which everyone receives at the end of the course and the certificate of excellence that the participants receive only if they reach the 75% of right answers after the post questionnaire." (P12)
		"We decided that the better way to collect this feedback and give them motivation is to offer them a certificate of participation." (P16)
		"We provide them certification of proficiency." (P17)
		"This is very easy to find the reports through Zoom, and see how much time they spend with us. When we saw that a person attended more than 30 min a course, then we were sending the certification." (P18)
		"We have something on gender and other things, we just recently inform a provider to gather this information." (P2)

Participant profile data being collected and available	Data sources
	"We are gathering their nationality address, their parents and name, their given name, parents name, surname, date of birth, gender and also the skills that they have to apply for the master. We gather the curriculum, the ID cards, and passport, and they also the diplomas, the degrees, the validated degrees." (P3) "We do collect information about what they come from, if they have worked previously, or if they have not, if they come directly from university, or if they come from industry. So it's just nationality, age, email, country of origin, country of residence. And so far, we do also know where they live when they enrol in the master programme." (P7) "We collect some information from the students, including the demographic data. So the age, the coming universities where they're coming from and even track record of the recent studies, the region, the county of origin, age, gender, whatever not many socioeconomic data." (P11) "We have collected different type of demographic data like the gender the organisation, the type of expertise and their role, job title, organisation name, organisation sector." (P12) "We collect both the nationality, but also their current living location, if they happen to be unemployed." (P13) "We record the gender status of our participants, whether they are female or male." (P14) "In terms of demographic data, we collect data on gender and current employment situation." (P15) "The information we collect about the people who register for courses are mainly if they are employed or unemployed, and most specific if they are working in an SME or some other industry. And also about gender. We can also see that we ask the country, the council." (P16) "We also collect information about the gender, we collect as a sort of demographic information, also the employment status." (P17) "requiring information such as their age, their gender, their professional background, their country of residence as well. ... If they are positioned within the organisation. Apart from that, we were also looking at the industries that they are coming from if they are employed." (P18)
	Data collection method
	"they will be our alumni, we will try to invite them later, and so on. So, this is why we collect a little bit more information rather than short-term courses." (P6) "for the second cohort, we are requesting a video, so they actually introduce themselves, and then we can have more data about the all the students." (P7)

Employability data awareness, but difficult to track		"We have a proprietary platform that we are using since long time." (P11)
		"regarding the demographics, we usually collect the data at the moment of registration" (P13)
		"And those are the questions that we're required to answer, everyone who registers for one of our courses has to provide that information." (P15)
		"from the emails and when they participate the courses" (P16)
	Data sources	"before joining a training session, either online or during a physical presence course, all participants had to register in our own registration forms." (P18)
		"I don't know if the other ones have had some changes, but what we receive from them because they are part of our alumni, they have somehow promoted in their position because of the training that they have received." (P3)
		"We plan to ask people about employment changes, this is a KPI for us, but you need to give some time for the changes to happen, after the course." (P4)
		"This is something very hard for us to track, I think that such kind of a training course can have a real impact on the employees professional career, I would say." (P12)
		"We have noticed some changes in employment status, but we have a few participants that have completed questionnaire. If you have a small sample, you can't actually say if it's working that way." (P14)
		"We do have information about people who were unemployed, and then upon receiving the training, they have improved either by finding a job or got a promotion, but that was a limited amount of participants." (P18)
	Data collection method	"from those 250 we have had around 25 given responses. So it's around 10% response rate when it comes to this long term feedback." (P13)
		"We have included this question as part of our evaluation that we initiated earlier actually, and participants are requested to mention if they have any changes in their employment status." (P12)
		"We have been sending out now new questionnaires to all the participants and we have been asking them to let us know." (P16)
		"this is a follow up questionnaire that we have created a very short one in regards to their attendance. We still, however, have the questionnaire open, and keep sending a reminder to our participants to answer the questions." (P18)

Annex C. Additional quotes for the Main Theme 2: Effective quality assurance management

Theme	Sub-theme	Illustrative Quotes
Quality Assurance in place as a standard	QA practices in place	"we have also the evaluation process of what implemented by now, and which is also currently on progress." (P2)
		"All modules and associated learning material will be systematically tested and evaluated by curriculum developers. Every student interaction with the ecosystem will be systematically evaluated by students as well as providers within the Track system. Peer review of the ecosystem by staff among the participating HEIs of different language expertise be conducted." (P4)
		"we do surveys as well like, at least in our case, we have multiple of them. One is about quality monitoring another about student feedback." (P6)
		"I do set a meeting with them like an informal meeting, and they tell me how they're doing, how the courses were, and so on. So it was actually the feedback from the review meeting." (P7)
		"The Andragolji, it's a type of pedagogical approach for adults. We have adopted this iterative approach meaning that we have used really, last year with the pilot, we used the pilot to collect and validate feedback, and also validate the content in a way with directly with the participants." (P12)
		"After the completion of the material we had the pilot testing phase. So before we launched the training offer. So this pilot came to validate the content that it was relevant that use usable it. It was aligned with the quality standards that we have." (P14)
		"We have qualitative indicators and quantitative indicators, and certainly in terms of impact, we'll be gathering feedback from those who have taken part in our courses." (P15)
		"we had also evaluations. So, then we have first a questionnaire for the people who implemented the course to collect a bit their opinions" (P16)
		"There is a first iteration in which there is, let's say, go-no go decision if the material is good to start the full review process. During the delivery of the courses, or after the delivery, we have two sources of feedback. The feedback from the from the learners that fill in this very detailed feedback questionnaire, but also there is a sort of assessment made by the training provider." (P17)

	Stakeholders in QA management	"under work package we have the evaluation form from the trainers and also trainees, both of them. So far the internal evaluation was enough overhead." (P2)
		"employ a comprehensive system of quality assurance at all levels involving all relevant stakeholders including the module developers, the course developers and providers, the internship providers, the participating students, the industry network, the national and European public bodies as well as the Quantum Flagship and the Digital Skills Coordination and Support Actions." (P4)
		"In Finland, they only have to consult and get the accreditation from internal bodies from the university. They are externally evaluated by their international agency." (P5)
		"In Portugal and in Greece, you have to go through both internal and external. You need to go through the scientific bodies of the universities to get scientific council's approval. Afterwards, we need to submit our processes to our national accreditation agencies." (P5)
		"Each training provider was responsible for the design and development of the of the training content. So, we have internally a specific committee for approving the content." (P12)
Standardisation top-down approach challenges	Misalignment with local rules	"gathering feedback from those who have taken part in our courses, and that includes the participants, the SMEs owners, the employees." (P15)
		"working on courses through our teams or by subcontracting other organisations, so which have the expertise, the appropriate trainers who will actually conduct the training sessions, and of course, to develop the material. Upon the completion of all the trainings, we have distributed another questionnaire, and to actually review the satisfaction of the participants" (P18)
		"we had a good communication, but sometimes everyone has to respect the rules and the details of every university." (P1)
		"it's a pity but French is a very complicated accreditation system... It's excellent, but it's very demanding. It's administratively very heavy, and universities just get fed up of that... in our case, they just had to go out of the project because of this, they would not get the accreditation on time." (P5)
		"We have three European countries, but they are from diverse national settings... We have not had at that moment the possibility of going through this European approach that we can have one single process being submitted to one of the national authorities. So we went in three separate procedures." (P5)

Standardisation bottom-up approach at the project level		"There are some challenging points. They are particularly related to regulations and laws. The most challenging thing we were facing when building up this programme was the topic of expert control and laws regarding getting people into the study programs." (P9) "they started with the accreditation, the three national accreditations, and that was a huge work, but they succeeded... we simply follow the institutional accreditations, and it means that they are totally backed by their own institutions and national laws." (P10)
	Resources constraints	that was institutional bureaucracy. And that was absolutely no-go... But it has to do, of course, with this whole accreditation bureaucracy. And the fact that it takes a whole year to have that done." (P10) "We want to build a specific one from the coordination to the programme. And this is why taking longer to build it, because obviously it's a lot of work. We don't have the time, as you can see." (P7) "when it comes to enrolment, administrative procedures, it is difficult... so far we are actually enrolling students manually. The Coordinator is actually doing the effort to send the information to all the other parties. So it is challenging... considering we cannot use just a simple, a single university server." (P7)
	Standardisation via setting up templates	"Now we have an harmonised form, and then some questions are being added by the respective course providers when they have a feeling. It makes sense for certain things to be added and to be answered." (P2) "so we have an electronic platform where the students apply for the programme and in that platform they have a specific module on monitoring and evaluation. And that's where develop the questionnaires for the students and also for the teachers." (P5)
	Standardisation via setting up standardised modules	"It was at first each university, but we managed to put everything together so we can all work together and have the same." (P1) "the firm commitment to be using the Competence Framework as a unifying language to ensure consistent communication and coordination among all stakeholders." (P4) "for these professional trainings, we have designed a very lightweight micro-credential for these courses on a kind of peer review by academics. So we take a board of programme commission of professors, of expert people with high level of knowledge on accreditation and we let them review the course against the European standards for micro-credentials." (P10)

		"We have tried to harmonise them in terms of duration. We have used Andragoji as main methodological approach to design the training courses. And really trying, based on the principles, to start from the theoretical aspects, but then integrate more practical activities or case studies or examples." (P12)
		"we use many materials that are built through the community in the carpentry. With that said, we adapt the each of the materials. We have always added some additional information to make it more relevant for target audience... We just made sure that we started the workshop in a very standardised way" (P13)
		"we succeeded also, after a long journey, to become issuer and awarding body for issued digital badges containing microcredentials adhering fully to the European Union guidelines." (P17)

Annex D. Additional quotes for the Main Theme 3: Resources & cooperation

Theme	Sub-theme	Illustrative Quotes
High level of resource readiness and strong industry collaboration	Engagement through providing staff	"The expertise are already present in the university. For the present moment we're using the staff within the universities." (P1)
		"done at each partner level. Not difficult to get experts to provide content for modules and these people work with a didactic expert for learning design of the content." (P4)
		"we have very different areas of study. That means that for us, it's not difficult to cover our three main components of the master." (P5)
		"we a little bit shifted like those existing personal because they had experience and so on, they were used for the master study teaching. Meanwhile, for the bachelor studies we are looking for new ones, like probably, for example, PhD student." (P6)
		"In relation to attracting and retaining academic and industry-based teaching staff for us has been quite easy in the way that all the professor finds the master programme very interesting." (P7)
		"The other Partners there here, they contribute more on the lecturing side so for instance lecturing on tools lecturing on specific design for a specific purpose things like that." (P9)
		"They are experts in the training experts or trainers specialised in different topics. Since the proposal, so the consortium was really composed of 2 main groups of partners, the training providers and the sector representatives. So, we had this structure since the very beginning." (P12)
		"Teaching part is not that challenging." (P13)
		"So far I haven't received any complaints or challenges in recruiting trainers that are relevant. and there has been a lot of and collaboration between the industry and the academia partners." (P14)
		"it's existing staff, so that would be at faculty level. But in terms of the project it's been consistent." (P15)
		"the teachers are all experts in their own fields, so they are researchers postdocs and professors. And we also have some people in the advisory board who are experts in the industry in the different countries and in Europe, and they are also experts in delivering training for companies." (P16)

		"all of us have the academic partners, they have the teaching structure and expertise by default. All the private partners are already training providers. So I would say no challenges." (P17)
	Co-design and co-delivery of courses	"It has not been difficult to find industrial partners. The level of involvement varies and some are full partners, developing and delivering content in classes." (P4)
		"We have one research institute, and they are very connected to industry. They give all industry courses and we have a few SMEs who work with industries. And there are industries themselves." (P10)
		"We took the opportunity within the project to involve the industrial partners, co-design, or improve the design of the curriculum with them." (P11)
		"we have also a group of stakeholders from the industry that are helping us on delivering the courses." (P5)
		"We had industry partners. We were consulting also when we were developing the study programme... we involve inviting SMEs just to have at least one lecture for our students just to make sure they see like, oh, it's relevant." (P6)
		"We rely on the industry partners to do the quality assurance of the content, mostly in terms of this suitability, where adequacy to the target group. The academics are the partners who develop the content. They are going to be the ones to do the delivery as well. But we rely on the industry partner for constant feedback." (P8)
		"In our consortium we have a strong level of cooperation between us from academic institutions, SMEs, and then the main academic, and the industry." (P14)
		"speaking to industry, we've organised lots of co-construction events in collaboration with our industry partner. So it's getting that important information and weaving that into the process, so that's an important element of our quality." (P15)
		"The interaction was very close, and the participation was almost continuous. I would say these companies are also participating in the delivery of the good implementation phase. So from the design to the implementation, and also to the assessment at the end." (P17)
		"we have also collaborated with another university here in Cyprus for the training providers to offer courses to job seekers, students, basically." (P18)
	Skills needs analysis	"Some have done workplace mapping, looking at jobs and associated skills to provide us with real-time market information on skill needs." (P4)

Challenge for SME involvement		"the SMEs are there to help to mention what the real needs are... I think what helped us was that we involved the actual participants in helping us identify the needs." (P14) "Another value is that once you engage with companies and you find out what their needs is in skills, you can better also train the students to become the workforce that they will need." (P16) "distribute a questionnaire asking HR managers and people to give us their training needs in regards to digital skills, which is the topic of our project. Upon receiving a large amount of data, we have analysed them and saw a trend in providing an interest in topics like marketing, advanced excel data analysis, and so on and so forth." (P18)
	Internships	"Others [industry partners] offer internships." (P4)
	Finance	"On the issue of the financing, the co-funding okay this 50% of the co-funding is very, very much demanding. In particular, you have these industry partners. 50% of co-funding can come from the salary of the teachers that are involved in the project. For a company a small and medium it doesn't, and 50% is really a lot." (P5) "those are the 2 challenges, right? The rate per country rate or common, the other one is the splitting of the financing is depending on the responsibilities, infrastructure, content, development or content, delivery or student experience." (P8) "During the project they decided to withdraw. So we had to then replace them with the other two partners. But this was mainly due to this co-financing issue of the 50%, because it was too, let's say, difficult for them to continue and co-finance the 50%. This was the main issue that we had." (P12) "I think academic entities have a 50% funding rate and small and medium enterprises have 75%. And then it is not becoming so appealing. Mostly with the current world situation. I think co-funding might be a bit of a challenge in the future. I know that this same programme might not exist in the future." (P13) "We had some requests from partners, asking when the interim payment would be completed, and when they will receive the next payment, because they were running out of money. And that's what I remember as a problem from 2 or 3 organisations, actually, that we're expecting very anxiously the payment to pay their staff." (P14)
	Administrative and procedural barriers	"the accreditation is very late, they could not start early with the marketing. The institution started to make problems not wanting to do the marketing, and so there was no marketing done until actually last week." (P10) "The process is not that streamlined so you can always apply for an accreditation, but you don't know exactly when you get the results. That's a problem... So there is no way with this type of accreditation processes that you can get the studies approved before you start." (P5)

lacks preparation to take off		"The heterogeneity that we have within the consortium is a strength, but it can also be a challenge in the sense that everyone has their own project back in their own institution and their own way of training, and sometimes there is a bit of resistance to adapt the workflow that we have." (P13) "It's a rather short funding, right? It's 3 years. I mean for us, it was a long shot, and we're very glad we made it. Also, it has been really cool experience of course, but I don't know how my admin office will feel about going through this again." (P13) "analysis was to happen within 6 months, but the time was too short. So we actually delayed work package 2." (P14)
	Capacity and expertise limitations	"But for the present moment we're still hoping if we can still have the financial budget... we're still studying all of this, how we'll manage it once the project will end, hopefully, it will never end." (P1) "We don't know yet whether that will work out. We're making the plans for that at the moment actually." (P2) "due to be discussed in a couple of months when there is sufficient experience of market demand under our belts." (P4) "So we are actually exploring and creating like a proceeding way of doing things like Professor could pay for that with some Erasmus funding or things like that. So we are working towards building that database in a way." (P7) "we have not yet enough data to say that for some of our partners, SMEs can deliver these courses commercially. Some of them and some courses we have still to wait how many people are prepared to pay a reasonable price for it in the future when it's not for free anymore." (P10) "I have to say my impression on that the model is particularly solid when we are able to attract non-European students... we'll continue to live even after the project termination. But the balance on the cost will be maintained only if we will be able to continuously attract students, even European and non-European." (P11) "We are considering different approaches in order to make the transfer training offer to remain after the project ends." (P14) "I think we're actively working on at the moment that sustainability plan for the courses, whether we were going to provide those on another platform, provide a fee for them. Those kinds of considerations are under discussion at the moment." (P15) So it depends if how is a balance between the efforts needed to make new courses or to develop new courses for new business cases or to update the current ones. So we have several possibilities in our business model." (P17)

Annex E. Additional quotes for the Main Theme 4: Participants' expectations & recommendations

Main theme	Sub-theme	Illustrative Quotes
Knowledge sharing	Organising more networking events	"I've got the crystal, clear impression that there is not a connection, a real connection between the depth programme and what they are doing in terms of training and what is being done by the GISIG and the employment. So this is really something should be improved." (P17)
	Establishing online knowledge sharing platforms and communities	"They were mentioning all possible platforms to have information on available programme and courses for adults or for you, young people, and so on, but the digital skills and jobs platform were not mentioned there. So my suggestion is that they speak each other a little bit more frequently." (P17)
	Harvesting current best practices	"And online platforms, for example, for email are essential if learners' mobility is to be facilitated. We used Discord initially and then developed our own platform." (P4)
		"It is important to identify the people involved, identify the important steps, more importantly, in terms of student attractions is to understand who is going to give them the support they need." (P7)
		the topics were interesting that we offered the students... they have to work in a group, and they have few weeks to build or design a solution for a certain real-world problem... We had SMEs working with us and we had some resource questions. And that they could interview us, and they designed a project and that approach is basically what we want in the master, and it works well." (P10)
		"an approach that we followed to manage the partners that is basically to be the more transparent, and the more involving decisions that we can, opening the channels of communication. And this helped basically all of the partners to felt involved in the process and to make them feel part of the results also. So I think this really helped negotiating the position." (P11)
		"You have live workshop, I think it's a bit more, even when you have the questions and answers through a pad, because the it lowers the barrier for people to raise their hand and answer questions. So I think that's something we're really happy with them. The format that we had for training." (P13)

		"We have asked the universities what their needs are, since a particular university actually run their own questionnaire asking their alumni and also their current students about their needs in training provision. We had a call with the Careers office of the Universities, and asked them to give us ideas on what courses we can implement on that.. And attract the participants through their efforts." (P18)
Quality Assurance management	Tailored and single-stop data collection	"My comment is that if you will be requesting data and make sure they are well informed, the coordinators are informed well in advance, so they know what that they will have to prepare. That's the company for the policy aspect." (P14)
Resources and cooperation	Leveraging current resources and industry collaboration	"The other thing which I think is really worth a lot is, that's not 100% completed but it's under completion, is this chip design, which is a will be open source so that universities can just use this for research purpose, also for teaching purpose and can effectively directly then immediate rebuild what we did." (P9)
		"To gather a very rich curriculum, you need to tap on all these expertises, and then this is when it becomes both an advantage, but also a challenge to have a heterogeneous consortium." (P13)
		"We have already implemented those courses through the HRDA, Human Resource Development Authority, which actually gives us the opportunity to offer a lot of training courses in the form of a seminar to participants with a fee." (P18)
	Providing continuous expert support to scale up their business ideas	"I know that the digital skills and jobs platform helps. But maybe something that could be even more efficient on getting students across Europe to apply for these programs." (P5)
		"So keeping some part of content of public available. But then for new additions, or having trying to access to more content or more content for additional information and then ask for right fee or something to pay in order to be sustainable." (P12)
		"We are examining methods like to change the offer to be paid in order to gain some revenue in and keep it running." (P14)
		"We hope to have some answers. Bottom line is that we want to continue. We don't know exactly how to set up and we hope to have more clear ideas in when and then that's fine." (P15)
		"Actually, we have, already, spoken with a lot of partners of the project to continue offering some of the courses with a fee, but not a substantial one ... It's good to keep updating platforms that are available to people either free of charge or

		with the fee to have something you know, to view learn a dedicate themselves. One initiative, for example, was the digital skills and the jobs platform " (P18)
Building a larger community for maintaining relationships and collaboration		"I think it's using each of the consortium partners network, because, I wouldn't call it networking myself... So here we really depend on each consortium member doing their own, or using their own networks on our behalf." (P13)
		"our communications leader has been disseminating all over SME connections associations." (P14)
		"the digital partnership, large skills partnership is managed by the digital SME Alliance, and which is also the manager of the digital skills and jobs platform. So you see, all the interrelation we have, we have with several key, let's say, stakeholders also recognised at the European ITC level be, let's say, the enabler of skills development in this specific sector." (P17)