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LEADS
ADVANCED DIGITAL SKILLS

EMPOWERING TOMORROW'S WORKFORCE BRIDGING THE DIGITAL SKILLS GAP THROUGH HIGHER EDUCATION AND VOCATIONAL TRAINING

27/10/2023

UPM

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1 TARGET AUDIENCE

This report covers the results of a workshop dedicated to analysing the challenges facing both Universities/Higher education studies and Vocational Education Training (VET) in bridging the gap and reaching the goal of providing more, deeper, and improved quality in ADS training to cover the needs of the workforce in Europe. This challenge is addressed from different points of view, namely Higher Education Institutes, Vocational Education and Training centres and industry perspectives. As Data Analysis and AI are part of the Advanced Digital Skills (ADS) scope, the workshop was developed in the context of the main world event in Big Data, the European Big Data Value Forum that took place in Valencia (Spain) on October 25-27.

It is assumed that the audience is familiar with the organisation of training in Europe as well as the demand of ADS in future projects and job forecast. This document will provide recommendations for the LEADs project, but at the same time for:

- Policy makers, EC and MS, including local governing bodies with responsibilities in education (especially VET and Higher Education). They will find high-level recommendations to be implemented to improve and define new synergies between HEI and VET, with the aim of enriching the ADS workforce.
- Educational institutions and leaders, mainly VET centre management teams, teacher associations and university vice rectors or department directors in charge of degree design and coordination). They will find suggestions for defining their curricula in a comprehensive way.
- Members of the technology industry community, particularly associations with an educational unit. They can find action points to promote ADS training inside their communities.

This is a public standalone publication and forms part of a series from the LEADS project to support the coordination of ADS development and as a record of proposed solutions for challenges in ADS gap in future European workforce.

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2 TOPIC INTRODUCTION AND MOTIVATION

The Leading European Advanced Digital Skills (LEADS) project aims to provide insights into the changing advanced digital skills (ADS) demands within a dynamic technological development and digital transformation context. The programme aims to suggest solutions to equip skill suppliers (education and training) with the knowledge, guidance, and best practices to shape the future of European ADS talent. In particular, WP3 is focused on Ecosystem Formation and aims to iteratively develop a series of practical guidelines for addressing the current and future supply of ADS whilst addressing the challenges and in addition, working to achieve the optimum solutions.

The high levels of demand for ADS jobs have been identified by several sources (e.g. World Economic Forum; Future of Jobs Report 2023). The European Commission has proposed a target of 20 million employees in ICT by 2030, although today only 47% of this target has been reached[1]. In order to reach this target, the LEADs project has established a requirement of between 3.5 million and 13.9 million new ADS professionals[2]. Figure 1 shows the future demand for ADS in the market (2027) with respect to the demand based on data from 2022, providing a general overview of the growth in the demand of the skills represented in the LEADS framework. It can be noticed that most of the ADS technologies will experience a notable growth, with those skills related to AI and data analysis being the ones with the most prominent demand growth, followed by cloud. In particular, the expected demand of AI and Data skills is expected to quadruple, while Cloud skills are expected to grow three times.

[1] A Sovereign and Competitive Europe – factsheet, DG CONNECT, EC, September 2023, https://digital-strategy.ec.europa.eu/en/library/sovereign-and-competitive-europe-factsheet.
[2] LEADs Deliverable 1.3. Final ADS Demand and Forecast Report.

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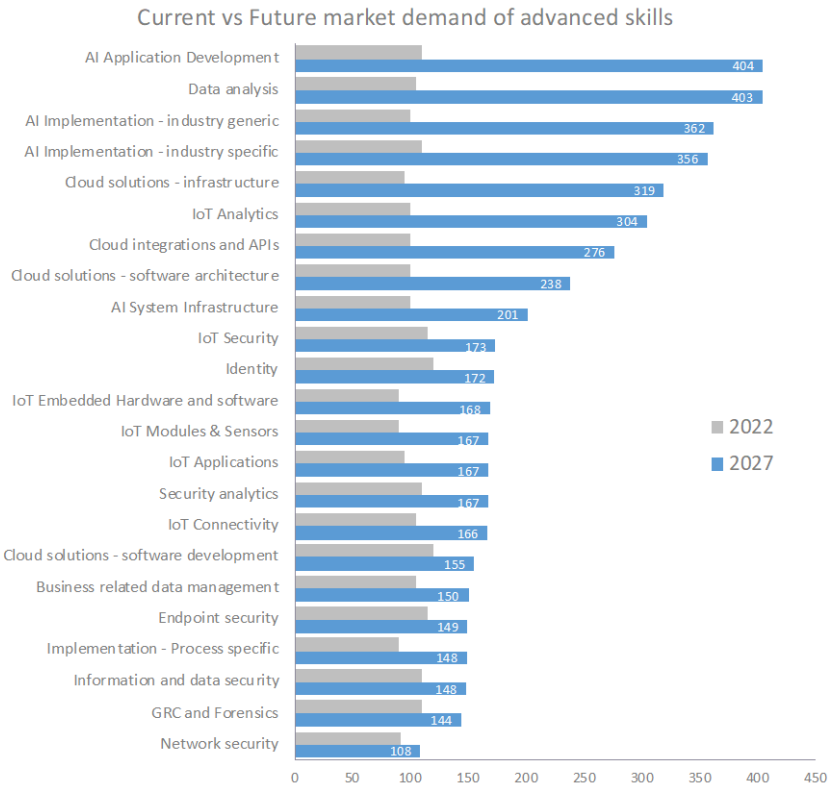

Figure 1. Current vs. Future market demand of ADS[2]

It is obvious that this demand needs to be covered through a range of mechanisms for skills provision: Higher Education, VET[3], in-house company courses, short-term courses, specialist training, etc.

Figure 2 summarises the LEADs results in terms of ADS demand and supply information[4]. The figure represents current and expected workforce (demand forecasting by 2027) within the different technology areas covered by the LEADS framework (AI, BI/Data Science, IoT, Cybersecurity and Cloud). In addition two scenarios, a "low growth" technology scenario and a "high growth" technology scenario are represented. On the other hand, the red dotted line in the chart above represents the estimated coverage in education within HEI, VET and online combined for each of the technology areas. While technology areas may present a different coverage depending on training modality and course type, the teaching of advanced skills in its totality is still not widespread enough to cater for the substantially high increase in ICT professionals needed by the industry over the next years.

[3] VET is the training in skills and teaching of knowledge related to a specific trade, occupation or vocation in which the student or employee wishes to participate. VET may be undertaken at an educational institution, as part of secondary or tertiary education, or may be part of initial training during employment, for example as an apprentice, or as a combination of formal education and workplace learning.
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Vocational_education_and_training_(VET).

[4] LEADs Deliverable D2.2. Gap Analysis.

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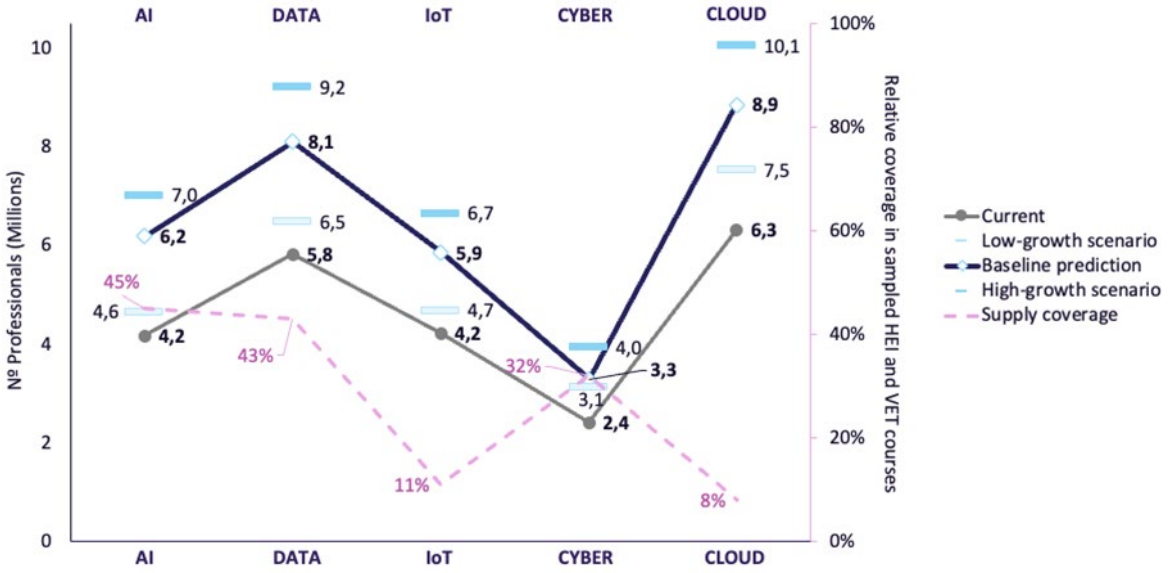

Figure 2. Workforce with ADS including demand predictions for different scenarios[4]

We face to a double-sided reality: shorter-term action of up-skilling and reskilling is needed, at the same time graduates with skills acquired over a longer term are required. Although one can see a high number of HEI programmes (bachelor and masters) responding to the demand, the situation differs when one VET courses. One of the main challenges we face is the cultural transformation: there is a need for continuous professional development. Non-degree credentials are growing in popularity. While degrees will remain as an important role in skill development, there is a need to urgently reflect in HEIs and incorporate methodologies and training models that incorporate public-private initiatives with a vision of addressing market problems.

Digital skills are practical skills, and the development of apprenticeships and other VET approaches provides mechanisms for talent to access new skills and career opportunities. This is especially relevant for technicians and for the recruitment of people from lower socioeconomic or disadvantaged backgrounds.

In summary, both Higher Education and VET will need to provide the bulk of the training required in Figure 2. To ensure that demand is adequately covered, alignment and cooperation between both are essential. At the same time, those demands requiring a university degree are heavily covered with current graduate rate, and VET graduates are candidates to continue or specialize studies whenever adequate and flexible pathways are provided. Finally, the very specific characteristics of some of the demanded profiles requires the alignment and cooperation of both educational levels. All these reasons justify this workshop, which tries to provide recommendations, and specific action points to answer the following top leading question:

How can we design a comprehensive strategy to allow integration across pathways in VET and HE courses?

To address this question the workshop has been organized around the following objectives:

- Share the success stories of our speakers on the alignment of vocational training and higher education.
- Discuss more relevant challenges for this alignment and good practices.

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- Obtain recommendations on how to address some relevant challenges in the VET and HEI alignment.

The detailed agenda of the workshop is provided in Appendix A. Due to the duration of the workshop (one hour), and with the aim to foster the discussion as much as possible, three speakers were carefully chosen to cover the main stakeholders involved in the higher education and VET relationship: traditional universities, industries, and universities specially devoted to vocational training. Appendix B provides specific details about the workshop speakers.

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3 CHALLENGES FOR HIGHER EDUCATION AND VET INTEGRATION

This section summarises some of the main challenges identified from the workshop that universities and VET providers face in bridging the digital skills gap through Higher Education and Vocational Training in ADS.

- *Accreditation*: Both in VET and HEI, current procedures are costly, slow, difficult and/or tedious and sometimes have no clear value for industry, especially in ADS where agility should be crucial. The process usually does not consider possible pathways between Higher Education and VET (especially adequate for some AI and Big Data profiles).
- *Soft skills*: HEI and VET curricula have limited inclusion of soft skills knowledge such as teamwork or stakeholder management, and, when they are included, it is delivered in a transversal way resulting in no adequate method to check when the students acquire them.
- *Curriculum*: The participation of industry in the design and implementation of (new ADS) curricula is not as wide and deep as needed in many cases. This is true for both university and VET curricula, in all areas (including AI and Big Data), and sometimes duplication can arise. This results in a gap between expectations from industry and current graduate pool.
- *Learning technologies and methods*: For new skills, new learning methods are needed. Technology devices, staff training, and implementing changes to programmes can be costly within already strained budgets. ADS teaching staff, in both HEI and VET, need to be trained not only on ADS, but on innovative learning methods and technologies.
- *Enterprise cooperation*: There is not always evidence of collaboration of educational institutions (HEI or VET) with the regional[5] ecosystem (SMEs, industry, local authorities, and communities) to reflect market needs and challenges in particular relevant areas like AI and Big Data, but generally applicable to all the ADS technologies.
- *Flexibility and cooperation*: HEI and official VET providers rules can be inflexible, and, in general, there is no culture of cooperation between institutions of different educational levels. For instance, most of the HEI training offer is tailored specifically for individuals who have completed university degrees, thereby excluding those without such credentials from accessing such training opportunities. The university mindset, which is very focused on formal degrees, should change through more cooperation with VET institutions and companies (e.g., in the identification of needs, or a shift in the curriculum design to offer short courses, micro-credentials, etc.) HEI and VET need to work together and work to complement each other offerings and ensure the diverse learning paths required are available.
- *Strategy*: There is a lack of strategic plans regarding ADS training, both in staffing and in the courses which are offered in HEI and VET. In the context of innovation, ADS needs must be considered. This is true at all levels: policies, companies, and educational institutions. Many national AI strategies have been developed, but not all emphasise training and course design.

[5] i.e. not only large urban clusters

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4 EXAMPLES OF GOOD PRACTICE IN THE AREA OF HE/VET

Below we present some examples of practices discussed during the workshop:

- *Institutional Collaboration:* EURASHE, as an association of universities with professional training, has established a number of Community on Practice, which consist of informal peer learning for exchanging good practices and contributing to capacity-building. One of them is dedicated to *Skills*, which gathers a poll of experts and relevant stakeholders including teachers, industry partners, policymakers, and others, to share best practices, foster innovation, and continuously refine skill development strategies and positions. Together, partnerships are forged that bridge the gap between academia and industry, ensuring that the skills imparted are relevant and in tune with the demands of the professional world. Among the activities of the community, there are common projects:
    - ApprenticeQ (management tools for apprenticeships)
    - MentorTrain (supporting mentors in companies - SMEs)
    - MERIDIES (commitment to the development of territories)
    - TRANSVAL-EU (innovative approaches for the validation of transversal skills), etc.
- *Cooperation between educational levels*: The Universidad Europea de Madrid has an internal programme OneUniversity for the development of final degree projects to solve practical industrial demands by teams that integrate several disciplines and educational levels (HE and VET). In the second edition, projects were focused on tools for the management of a golf course. Among other, it is worthy to mention Tank Management, for supply of fuel to different vehicles and machinery (Computer Science, Mechanics, Business), Course management (Sport studies, Computer Science, Education), Sport results, Green maintenance, etc. In most of them, the management of (Big) Data is needed. This practice allows students to face to real problems in multidisciplinary teams, simulating the work environment in a professional context.
- *Microcredentials courses offered by HE institutions*: Trinity College[6] has organized a coherent and flexible offer of micro credentials (short, accredited learning experiences that facilitate flexible and innovative professional development) using ECTS measure (5 - 10 ECTS for course), specifically designed to support learners wishing to keep pace with the fast-changing needs of industry and society, face-to-face, blended and online delivery, taught by leading Trinity experts in their fields. The offer includes: Leading Business Analytics, Big Data and AI, Leading Teams, Transport Modelling and Planning, Air Pollution: Monitoring Assessment and Control, Cyber-physical Systems and Control, or Digital Health. This is an interesting example about how VET can be introduced in HEIs complementing and enriching their training offer.
- *Rich spectrum of talent acquisition.* The representative from industry explained how in his company they use different criteria to hire ADS talent. They work with a clear separation of roles, those that require a deep background for long-term positions should be filled by university graduates; short term task with very specific capabilities might not require a graduate but a professional with vocational training. It was specifically mentioned a ratio of around 40-60 (higher education vs training) in their teams composition and, how his company relies on training to be part of the contracting of new technology solutions with a significant investment. This practice is a tangible outcome of their organisational strategy.

[6] Online Micro-credentials, TCD, September 2023, https://www.tcd.ie/OnlineEducation/micro-credentials/.

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5 RECOMMENDATIONS AND ACTION POINTS

Below we present some recommendations with examples of action points derived from the workshop, either gathered directly form the speakers' presentation or through the debate. Some of them have already appeared in other LEADS workshops, which indicates the importance of these suggestions. The recommendations have been grouped according to their main actor (training providers, policy makers and industry). For each action point, its relation to HEI, VET or both is also shown.

Table 1. Workshop recommendations and action points by main actor

Actor	Recommendations	Action Points	HEI	VET
Training providers	Offer Versatile and Comprehensive Curriculum	• *Redesign the bachelor degree* to ensure that the graduates have the ability to cope with many different projects, many different aspects and accept new challenges, so they are ready for a lifelong learning process involving both formal and VET. • *Push for interprofessional and transdisciplinary practices being flexible enough in pathways*, not only between educational levels but also between disciplines (e.g., a restaurant app with participation of students of ICT – from VET, Food Technology – from University, AI and Data specialist, and Art – from a Master course.) • *Include soft skills:* ethics, communication, knowledge of business, critical thinking, creativity must be included and a method of checking that the student has acquired knowledge of these skills must be implemented, both for HEI and VET.	✓ ✓ ✓	 ✓ ✓
	Revitalize Higher Education	• *Offer non formal short courses with micro-credentials* cooperating with industry and VET providers to cover the industry needs and to provide general certifications (e.g., IOT *Sustainability* + Applied IOT + Ethical aspects of IOT; AI tool + AI ethics + Analytics) • *Open the offer with online or blended approaches* to increase the potential candidates to be trained.	✓ ✓	✓ ✓
	Standardise Training Proposals	• *Provide a standard for training proposals.* That is a standard description of ADS training alternatives (short courses, official degrees, …). A standard template could ensure that all *proposals* share the same information, allowing offer assessment, comparison, publicity and recognition.	✓	✓
	Create a Unified Training Hub Platform	• *Create a common access point for available training* according to the profiles. Existing Regional/National/EC initiatives can be used for this purpose by federating proposal sites automatically (that could also be hierarchical – region, national, European, …) and, therefore, creating an efficient and simple way of inserting the information in the site. It is also possible to use these sites for other purposes: demand from companies, free recorded courses, etc.	✓	✓

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	Make Innovation part of Institutional Strategy	• Provide educational institutions, both HEI and VET, with a clear medium-term strategy on new courses, degrees, and mechanism to address society demand (maybe by using an advisory boards). This needs to be combined with offices and dedicated staff to manage aspects like strategy, innovation, cooperation, etc. Innovation is not linear in research, and professionalisation is needed in institutions. • *Include in the strategy the definition of deployment* and strategies for deployment, including staff training.	✓ ✓	✓ ✓
Policy Makers	Allow for Flexibility accessing Training Opportunities	• *Open specialisation (non-formal) courses both from universities and VET centres to all students*; there is usually a restriction (in some cases by rules, in other cases by mindset) applied to *students* (i.e., university courses only for to university degree holders, VET centres courses only for VET degree holders).	✓	✓
	Agilise Accreditation	• *Trust* high *reputational institutions* to create a more efficient and responsive accreditation *process*. • *Regulate and propose possible pathways between HEI/VET* inter *level, transdisciplinary and interprofessional* (e.g., VET students continue studies in university, holders of a degree in Humanities to ICT specialization, etc.). • Regulate, when possible, the recognition of prior knowledge for learners.	✓ ✓ ✓	✓ ✓ ✓
	Create an Integrated Training Plan	• *Design and implement coordination and strategic plans for higher education* as a whole. In many cases, VET and HEI relies on different ministries or separate departments in a single Minister, which does not help on coordination.	✓	✓
Industry	Include ADS Training in Corporate Planning	• *Include staff training in ADS and talent acquisition* of employees to address ADS challenges in strategic plans. The specific requirements for HEI and VET talent acquisition should be defined and known in the organization.	✓	✓
	Promote ADS Training in Industrial Groups	• *Include ADS training in activities of industrial groups of interest* (for example, BDVA, AIOTI, …) *or professional associations* (engineers, doctors, teachers, …) beyond common markets, technologies, innovation and research.		✓

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6 CONCLUSIONS

Advanced Digital Skills (ADS), including AI and data science, are a key element in the design of the digital future of Europe. Universities, VET centres, and industry should be involved in providing more, deeper, and increasing quality in ADS training to cover the needs of the workforce in Europe.

A relevant number of recommendations and action points have been generated from this workshop, which are discussed in previous sections. Below we summarize them in a few takeaways:

- A mindset of lasting collaboration between professional education, industry, and university is essential. There is a need to recognise learning in a different way that reflects the challenges ahead: applied research, recognition of prior learning activities, pathways between educational levels, activities, courses, learning programmes, and activities and training in different formats, apprenticeships, and microcredentials. For that aim **flexibility** during all the training process, HEI and VET, is a must.
- Some degree of **standardisation** in the training offer is needed to allow students compare and choose among such offer, as well as to allow recognition of such offer by industry and other training providers. This is particularly relevant for VET training where there is a wide spectrum of courses.
- Complementarily, taking a practical approach should be the rule. Generating solutions by integrating the benefits from both education providers and through collecting and expanding on good practices of **cooperation** between training providers and industry, as well as among training providers themselves, especially HEIs and VET providers.
- Accreditation processes need to be more **agile** and efficient to allow training providers to quickly adapt to industry needs.
- Finally, it is essential to be more **strategic** at all levels (educational institutions, policies, industry) in the challenge of trying to provide advanced digital skills to meet the high demand. In this sense, each company should also define its own strategy and requirements for HEI and VET talent acquisition.

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APPENDIX A. WORKSHOP DESCRIPTION AND AGENDA

European Big Data Value Forum (EBDVF) is the flagship event of BDVA, bringing together the entire European data-driven AI research and innovation community to share knowledge, collaborate and celebrate achievements. The 2023 event took place in Valencia, Spain, from October 25 to 27.

The 2023 edition is built around the theme "Data and AI in action: Sustainable Impact and Future Realities". The event brings together industry professionals, business developers, researchers, and policymakers from all over Europe and other regions of the world to advance policy actions and industrial and research activities in the areas of Data and AI. EBDVF takes a comprehensive view of these topics from the perspective of many European economic sectors, not forgetting the societal implications of the rapidly advancing technologies.

While some other sessions of EBDVF mention the skill issue, the session covered by the LEADS workshop was the only one focused on ADS and cooperation without different educational levels with different points of view: industry, universities, and educational institutions.

In this session, we will concentrate on vocational training and higher education and will analyse some success stories in this field. The main outcome of the session will be to learn from success stories to help fill the gap between demand and offer in ADS.

The agenda of the meeting is presented in Table 2.

Table 2. Workshop agenda

Start	Duration	Item description	Presenter
October 27th, 2023, Empowering Tomorrow's Workforce: Bridging the Digital Skills Gap through Higher Education and Vocational Training Demand			
09:00	5 min	Welcome	Ana M. Moreno, UPM
09:05	5 min	Context setting: the ADS challenge	Brendan Rowan, BluSpecs
09:10	10 min	Reflections of deploying VET practices in HEI	Julie Byrne, Trinity College
09:20	10 min	Approaches from across HEI in Advanced Digital Skills	Marta Rodrigues, EURASHE
09:30	30 min.	Practical Upskilling in Companies	Carlos Fernandez Iñigo, Informa
09:40	15 min.	Panel Discussion	Speakers
09:55	5 min	Summary	Juan José Moreno-Navarro, UPM
10:00	**End of meeting**		

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APPENDIX B. INVITED SPEAKERS

The speakers were chosen to cover the main stakeholders related to the aim of the workshop, industry, and academy, both university and VET centres. The speakers invited to the round table were:

Carlos Fernández Iñigo is the Deputy General Manager of INFORMA D&B, S.A.U. (S.M.E.). Carlos Fernández holds a Degree in Physics and earned an MBA from the "Instituto de Empresa" in Madrid. His professional career has been developed in companies such as Saint Gobain, Indra, Reuters, and Fedea. At the present time, he is Deputy General Manager at INFORMA, General Manager at Dail Software, S.L. and member of the board of the XBRL Spanish Jurisdiction. Additionally, he is a member of the Alcobendas City Council Open Data Advisory Board. This entity is firmly committed to continue advancing and publishing information, in reusable format, to generate social and economic value.

Marta Rodrigues is the Policy and Project Manager at EURASHE. The European Association of Institutions in Higher Education (EURASHE) was founded in 1990 as an international association promoting and emphasising Professional Higher Education. Members are colleges, polytechnics, university colleges, applied sciences, and universities with their professional training. Marta is responsible for following the European policy developments on Higher Education, Skills, Research, and Innovation. She is also in charge of developing and implementing European and international projects in those areas.

Julie Byrne is an Assistant Professor at Trinity College Dublin. She is Professor of Online Education & Development at Trinity College Dublin. She led the development of Trinity's first fully online postgraduate programme and is a Lead in Trinity's Microcredentials project offering an online micro credential in Digital Technologies in Human Services.

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