Expanding Horizons: mapping the frontier of apprenticeships in emerging sectors using big data

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New fields for apprenticeship

Lightcast

Introduction

- Technological change and shifting labour market demands are reshaping the role of apprenticeships in modern economies.

- To keep pace, vocational education must evolve, ensuring learners can develop the right skills for tomorrow's jobs.

- This paper uses big data from Lightcast Global job postings to explore how apprenticeships can expand into three emerging sectors: FinTech, Cybersecurity, and Education Technology. It introduces a new metric: **the apprenticeship success rat**e, to assess how effectively different skills can be taught through work-based learning.

- The goal is to provide a clear skills framework to guide the future of apprenticeship training in high-growth, high-impact fields.

Methodology (1)

Selecting apprenticeships new fields of application

EU-LFS (Eurostat)

- Offers EU-wide insights on how vocational education supports transitions into work.
- Employees by educational attainment level and NACE Rev. 2 activity
- We focused on individuals with Upper secondary and post-secondary non-tertiary education (ISCED levels 3 and 4) – vocational programmes.

Italy's XXI VET Monitoring Report

- Maps apprenticeship uptake within Italy's dual system, identifying both established sectors (e.g. engineering, health) and emerging opportunities in digital and sustainable fields.
- Data are from IeFP system (Istruzione e Formazione Professionale), focusing on enrolment and qualification trends across vocational pathways. IeFP refers to the regional VET system. It focuses on delivering practical skills and occupational knowledge to prepare students for entry into the labour market or further studies (Type 1 Apprenticeship).

UK Apprenticeship Statistics:

- Provides detailed enrolment data across sectors (source: ONS), revealing patterns and gaps in the application of apprenticeships, especially in high-skill or underrepresented domains.

Insights from EU-LFS on emerging fields and skills needs

EU-LFS data shows vocationals remain concentrated in traditional sectors like construction and manufacturing.

- Evidence (Cedefop, 2018) underscores the scale of this challenge, revealing that as early as 2013, four in ten EU employers reported difficulties in finding recruits with the right skills.

- Digital and green sectors (e.g. IT services, FinTech, renewable energy) show growing demand for skilled labour.

- Apprenticeships are underutilised in these fields despite strong technical and practical skill needs.

- Vocational education (EUROSTAT, 2023) is defined as training that prepares individuals for direct entry into specific occupations.

- Expanding apprenticeships in emerging sectors can support smoother education-to-work transitions.

Eurostat - Educational attainment level and transition from education to work (based on EU-LFS) - Employees by educational attainment level and NACE Rev. 2 activity - Upper secondary and post-secondary non-tertiary education (levels 3 and 4) - vocational

Source: Eurostat - Educational attainment level and transition from education to work (based on EU-LFS) elaborated by the authors
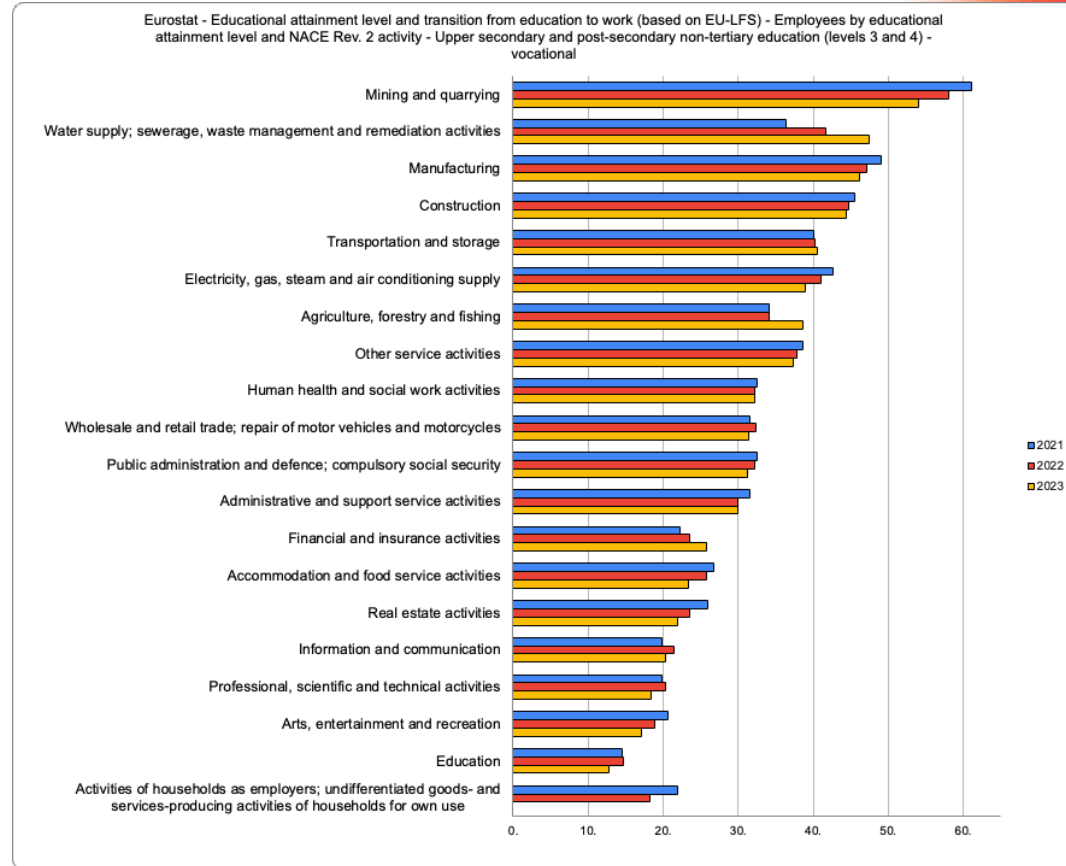
IeFP in Italy: traditional strengths, emerging opportunities

INAPP data confirms Italy's strong apprenticeship base in traditional sectors, yet highlights room for growth in digital fields.

- Wellness, hospitality, mechanics, and food services dominate enrolments in early vocational years.

- Type 1 Apprenticeships remain central to the dual system, combining classroom learning with company-based training.

- Enrolments drop sharply after the 3th year, showing weak progression to advanced technical qualifications.

- Emerging fields like FinTech, Cybersecurity, and EdTech are underrepresented but rapidly growing.

- Strengthening vocational pathways into these digital sectors is essential for future workforce resilience.

Source: INAPP. (2023). XXI Rapporto di Monitoraggio del Sistema di Istruzione e Formazione Professionale e dei Percorsi in Duale nella IeFP a.f. 2021-22

Table 2.   **Italy - Distribution of enrolments by professional figures by year - 2021-22**

Italy - Distribution of enrolments by professional figures I-III year - 2021-22 (Top 10 Occupations)

Wellness operator	33,618
Catering operator	25,280
Motor vehicle repair operator	10,527
Electrical operator	10,450
Mechanical operator	9,907
Food production operator	6,184
Graphics operator	5,751
Promotional and Reception Services Operator	4,153
Business services operator	3,495
Agricultural operator	2,629

Italy - Distribution of enrolments by professional figures IV year - 2021-22 (Top 10 Occupations)

Beauty treatment technician	1,982
Hairdressing technician	1,955
Kitchen technician	1,757
Motor vehicle repair technician	1,449
Graphic technician	1,121
Food production technician	1,004
Bar and restaurant services technician	898
Production plant planning and management technician	795
Industrial automation technician	754
Electrical technician	727

Source: INAPP. (2023). XXI Rapporto di Monitoraggio del Sistema di Istruzione e Formazione Professionale e dei Percorsi in Duale nella IeFP a.f. 2021-22
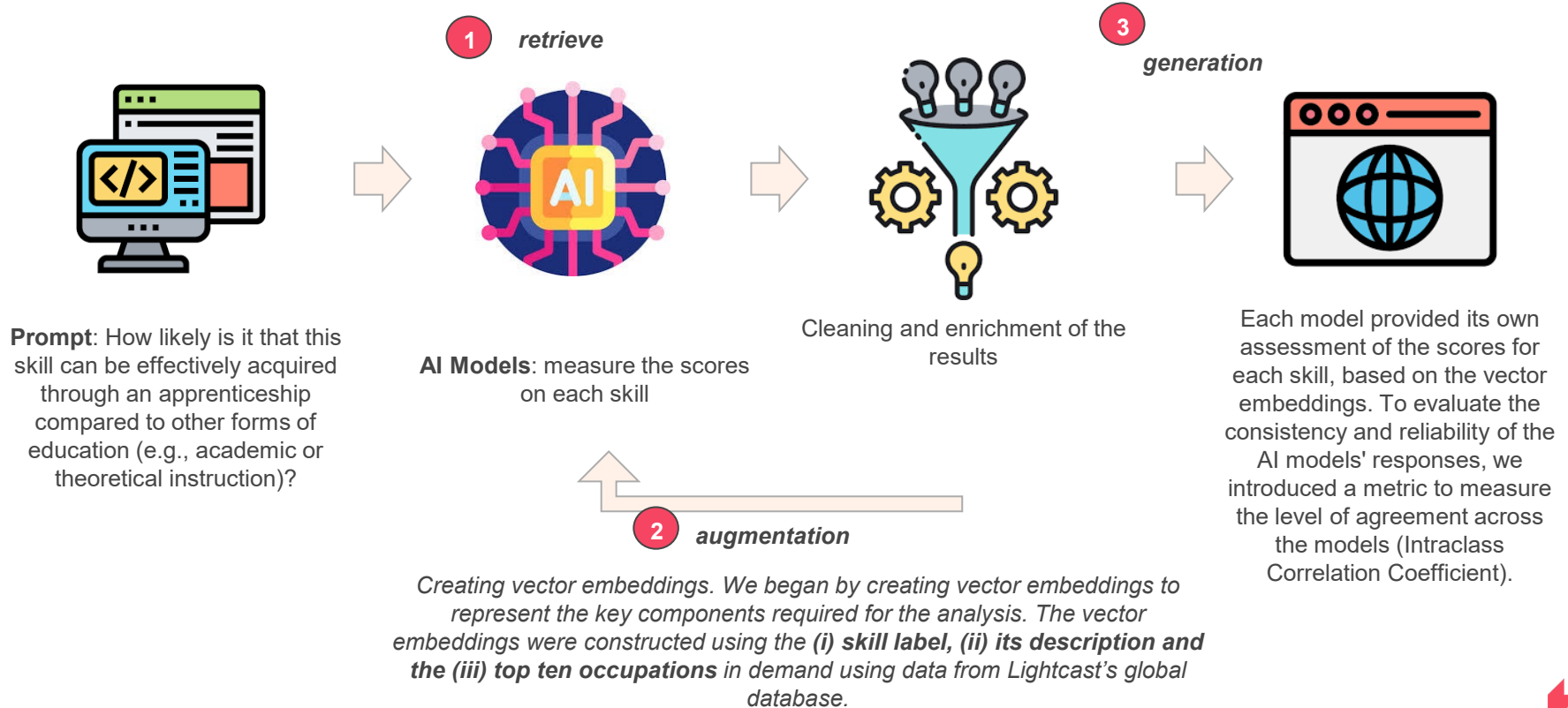
UK Apprenticeships: Broad Reach, but Gaps in Digital and Emerging Sectors

ONS data shows wide coverage, but digital fields like FinTech and Cybersecurity remain underrepresented.

- Strong enrolments in foundational sectors, with Accounting & Finance (4.9%) and ICT Practitioners (4.15%) showing digital interest.

- FinTech and Cybersecurity lack clear visibility, suggesting low uptake or gaps in programme design.

- ICT accounts for just 0.03% of all apprenticeships, highlighting a critical mismatch with digital economy needs.

- Media & Communication (0.19%) and Environmental Conservation (0.08%) also show untapped potential.

- Targeted apprenticeship expansion is needed to meet demands for tech talent skills. CompTIA (2023) notes, "employers can transform IT hiring by integrating structured apprenticeship programs that combine hands-on experience with foundational knowledge."

Methodology (2)

1 *retrieve*

3 *generation*

Prompt: How likely is it that this skill can be effectively acquired through an apprenticeship compared to other forms of education (e.g., academic or theoretical instruction)?

AI Models: measure the scores on each skill

Cleaning and enrichment of the results

Each model provided its own assessment of the scores for each skill, based on the vector embeddings. To evaluate the consistency and reliability of the AI models' responses, we introduced a metric to measure the level of agreement across the models (Intraclass Correlation Coefficient).

2 *augmentation*

*Creating vector embeddings. We began by creating vector embeddings to represent the key components required for the analysis. The vector embeddings were constructed using the **(i) skill label, (ii) its description and the (iii) top ten occupations** in demand using data from Lightcast's global database.*

Remotability of skills and success ratio of apprenticeships (1)
Definitions

Table 3. Remotabilty and Apprenticeship Success Ratio - Examples from the Lightcast Open Skills taxonomy				
Skill	Remotability Score	Apprenticeship success-ratio Score	Agreement metric (Remotability Score)	Agreement metric (Success-ratio Score)
Plumbing	0.2	1	0.95	0.91
Python (Programming Language)	0.8	0.9	0.88	0.84
Financial Forecasting	0.7	0.6	0.69	0.72
Special Education	0.3	0.7	0.79	0.86
Community Education	0.6	0.8	0.73	0.68
Cyber Engineering	0.7	0.8	0.77	0.75
Cyber Laws	0.7	0.4	0.51	0.58
Cyber Security Policies	0.7	0.6	0.7	0.81
Mechanical Tools	0.2	0.9	0.89	0.93
Thermomechanical Analysis	0.3	0.6	0.71	0.79
npm (Node Package Manager)	0.85	0.78	0.9	0.89
SQL Server Express	0.8	0.98	0.9	0.76
Lean Warehousing	0.75	0.65	0.85	0.56

Source: Authors elaboration over Lightcast Global Postings.

(a) **Remotability of skills:** Can this skill be effectively used in remote work settings, or does it require physical presence to perform? In this context, remotability refers to the degree to which a skill is compatible with remote or telework arrangements. For example, digital communication or coding skills may be highly "remote" while machine operation or caregiving typically require physical presence.

(a) **Success ratio of apprenticeships:** How likely is it that this skill can be effectively acquired through an apprenticeship compared to other forms of education (e.g., academic or theoretical instruction)? The success ratio reflects the relative suitability of apprenticeship training for a given skill, capturing the effectiveness of learning that skill in a work-based, practical setting.

Remotability of skills and success ratio of apprenticeships (2)
Scenarios

Table 3.	Remotabilty and Apprenticeship Success Ratio - Examples from the Lightcast Open Skills taxonomy			
Skill	**Remotability Score**	**Apprenticeship success-ratio Score**	**Agreement metric (Remotability Score)**	**Agreement metric (Success-ratio Score)**
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Cyber Engineering	0.7	0.8	0.77	0.75
Cyber Laws	0.7	0.4	0.51	0.58
Cyber Security Policies	0.7	0.6	0.7	0.81
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Source: Authors elaboration over Lightcast Global Postings.

(a) **Low remotability and high success ratio (e.g. Plumbing).** This is the ideal apprenticeship scenario. The skill must be performed in-person and is most effectively learned through direct workplace experience.

(b) **High remotability and high success ratio (e.g. Python).** This might seem counterintuitive at first, why would a skill that can be done remotely benefit from an apprenticeship? This reflects cases where mentorship, real-world application, and iterative feedback are still important. In tech roles, even if remote work is feasible, structured work-based learning adds significant value for junior learners navigating complex tasks.

(c) **High remotability and moderate success ratio (e.g. Cyber Law).** These skills may be easily performed remotely but require theoretical depth (e.g. legal frameworks, regulatory compliance.

(d) **Moderate remotability and high success ratio (e.g. Community Education).** These are "hybrid" roles, where both interpersonal interaction and flexibility are needed. Apprenticeships work well here because they combine practical exposure to real communities with reflective learning, even if parts of the role can be performed remotely.

(e) **Low remotability and moderate success ratio (e.g. Special Education).** Some hands-on roles, especially in complex human-centered domains, may not fully benefit from standard apprenticeship structures due to emotional, ethical, or pedagogical sensitivities, which require more than just experiential learning.

Methodology (3)

Job postings data and framework skills set

DATA SOURCES

- Lightcast proprietary data

- Billions of job postings scraped daily from thousands of online job boards, newspapers and employers sites

- Cleaned, deduplicated and categorised.

TIME FRAME

- Job postings data allows to capture almost-real time insights from the labor market

- The analysis presented in this paper is based on 2018-2023 data

SAMPLE QUALITY

- Only captures job postings that have been published online.

- This works best for professional services jobs - less so for others, such as agriculture.

- Quality of the data is based on what employers mentioned in the postings. Some things may be taken for granted.

Methodology (4)

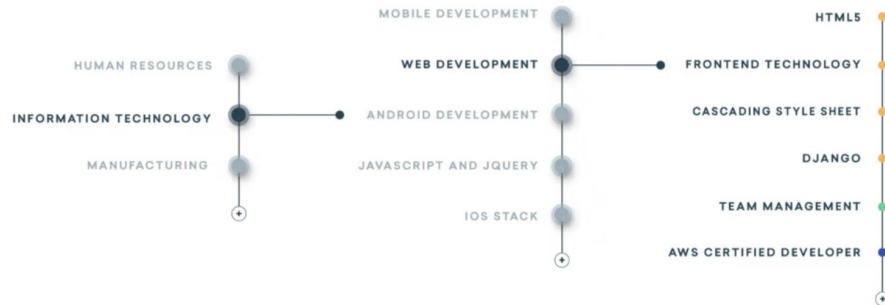**LIGHTCAST OPEN SKILLS TAXONOMY**

OVER 32,000 SKILLS

- Granular classification
- Regularly updated

SPLIT INTO 3 CATEGORIES

- Common skills
- Specialised skills
- Software skills

ORGANISED HIERARCHICALLY

- 32 thematic skills categories
- 400 skills subcategories

Defining Framework Skills Sets

Identifying in-demand, apprenticeship-aligned skills in emerging sectors

- A framework skills set combines technical, regulatory, and transversal skills essential in a sector.

- Built using co-occurrence analysis from job postings (Lightcast), filtered by sector-specific relevance.

- Skills were tagged as remotable (score > 0.6) or high-impact for apprenticeships (score > 0.7).

- Skills outside these thresholds may require hybrid or classroom-based models.

- The framework supports targeted, work-based learning in FinTech, Cybersecurity, and Education.
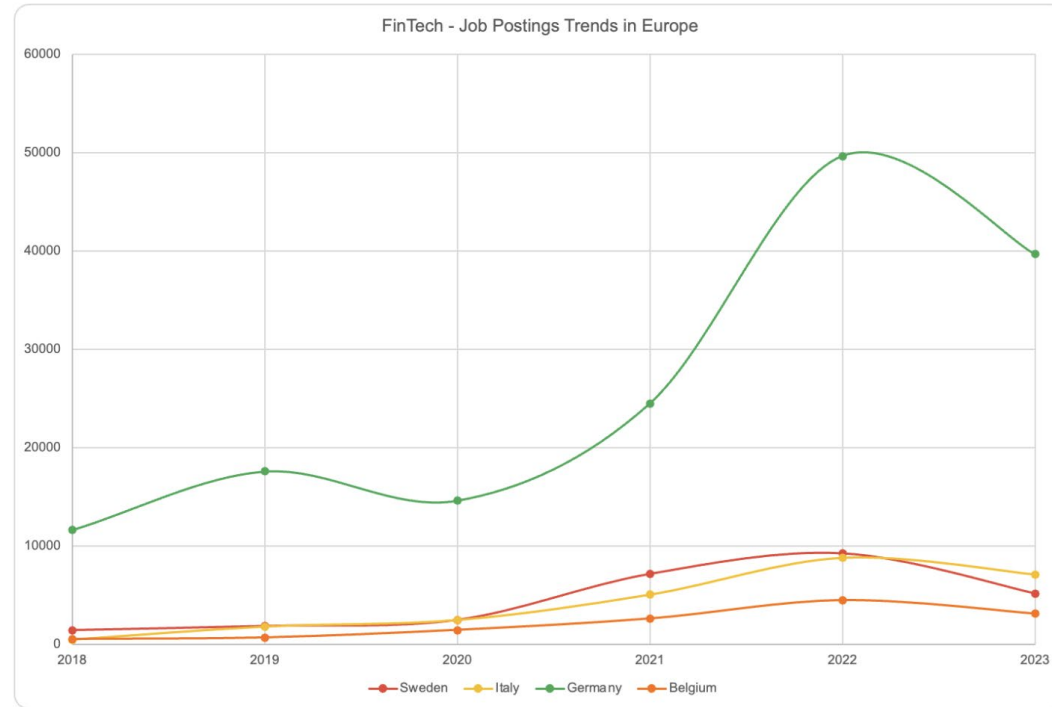
Finance Technology

FinTech refers to the integration of technology into financial services to improve operations, delivery, and customer experience.

- Selected countries: **Germany, Sweden, Italy, and Belgium** - key FinTech hubs with growing demand for digital finance skills.

- Rising job demand: Significant growth in FinTech-related postings (2018–2023), especially in digital banking, compliance, and automation.

- Top occupations: Personal Financial Advisors, Accountants, Financial Analysts, and Auditor.

- Skill shift: Increasing need for hybrid profiles blending finance, tech (e.g. data analysis, automation), and regulatory knowledge.

  Apprenticeships can address talent gaps by offering hands-on learning in emerging FinTech roles.

Source: Lightcast Global Postings

Figure 3.   **Finance Technology - Job Postings Trends in Europe**

FinTech - Job Postings Trends in Europe

Skills framework for apprenticeships in the FinTech sector

Top skill categories

Top skill

FinTech

Top job titles used for recruitment related to FinTech include: Accountants, Compliance Officers, Financial Accountants and Financial Analysis

| Finance |
| Law, Regulation, and Compliance |
| Business |
| Information Technology |
| Marketing and Public Relations |
| Other categories |

Finance · Accounting · Anti Money Laundering · Invoicing
Financial Technology (FinTech)

Auditing · External Auditing · Internal Auditing

Risk Management · Process Improvement · KPI

Financial Statements · Project Management

Automation · Data Analysis · SQL

Marketing · Value Propositions

Agile Methodology · Problem Solving
Teamwork Principles

Skill label — Remotable

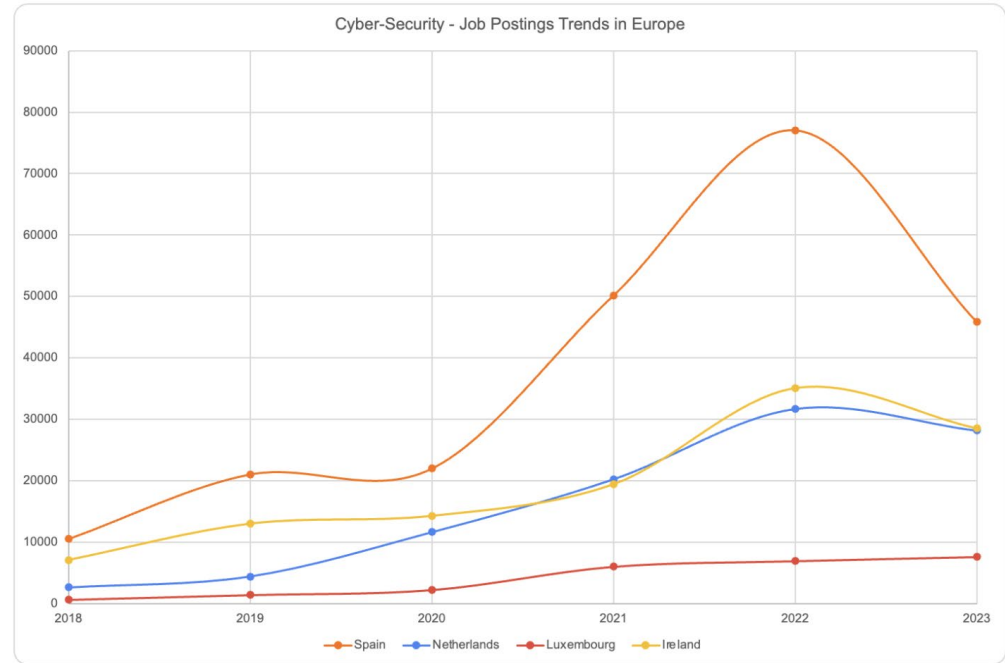Skill label — High-Impact Apprenticeships

Cyber security

Protecting digital infrastructure and data through secure systems, policies, and skilled professionals.
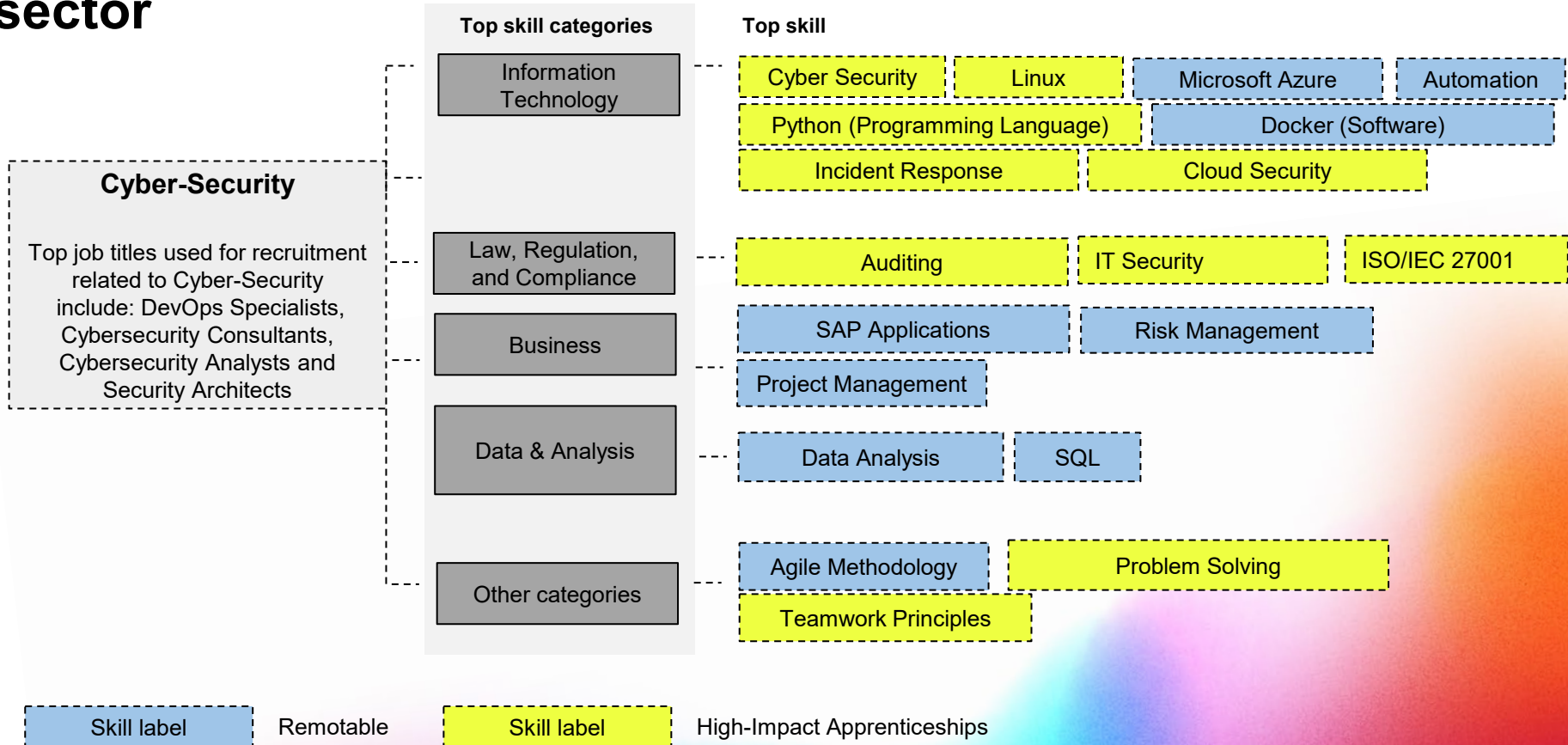
- Selected countries: Spain, Netherlands, Luxembourg, Ireland - strong policy push and demand for cybersecurity talent.

- Demand surge: Job postings quadrupled from 2018 to 2023, peaking in 2022 due to accelerated digitalisation and cyber threats.

- Top occupations: Cyber/Info Security Analysts, BI Analyst, Network Administrators, and Support Specialists.

- Key skills: Cybersecurity, Linux, Microsoft Azure, Python, Incident Response - ideal for hands-on, apprenticeship-based learning.

Apprenticeships in cybersecurity bridge the talent gap, offering practical experience in mission-critical roles.

Figure 6.   **Cyber Security - Job Postings Trends in Europe**

Cyber-Security - Job Postings Trends in Europe

Spain — Netherlands — Luxembourg — Ireland

Skills framework for apprenticeships in the Cyber-Security sector

Cyber-Security

Top job titles used for recruitment related to Cyber-Security include: DevOps Specialists, Cybersecurity Consultants, Cybersecurity Analysts and Security Architects

Top skill categories

Information Technology

Law, Regulation, and Compliance

Business

Data & Analysis

Other categories

Top skill

Cyber Security | Linux | Microsoft Azure | Automation

Python (Programming Language) | Docker (Software)

Incident Response | Cloud Security

Auditing | IT Security | ISO/IEC 27001

SAP Applications | Risk Management

Project Management

Data Analysis | SQL

Agile Methodology | Problem Solving

Teamwork Principles

Skill label | Remotable

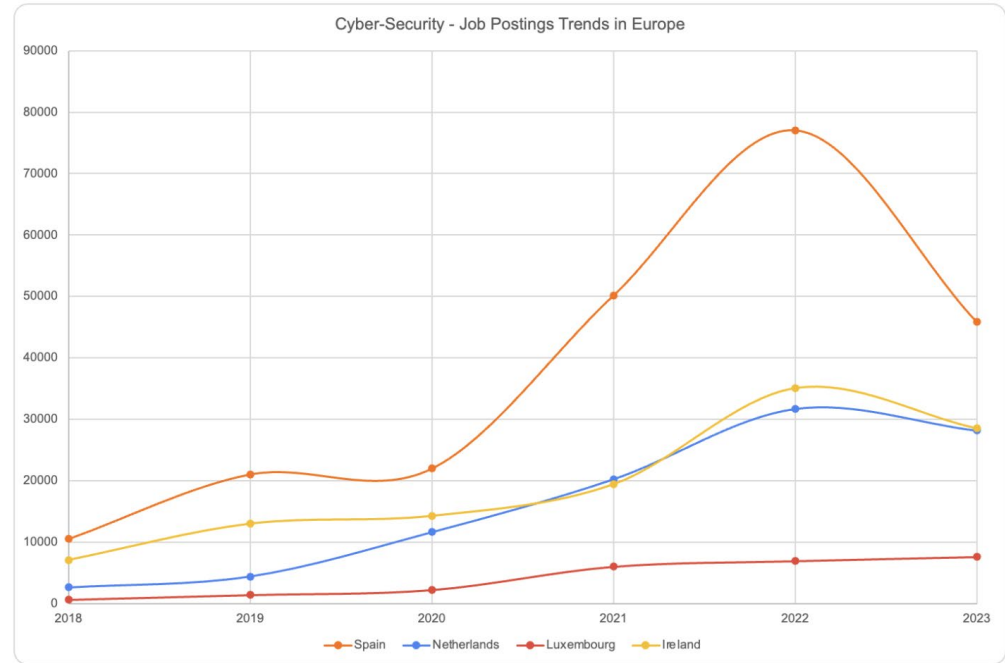Skill label | High-Impact Apprenticeships

Education

Focus on special needs, childcare, and tech-enhanced learning - not the full education sector.
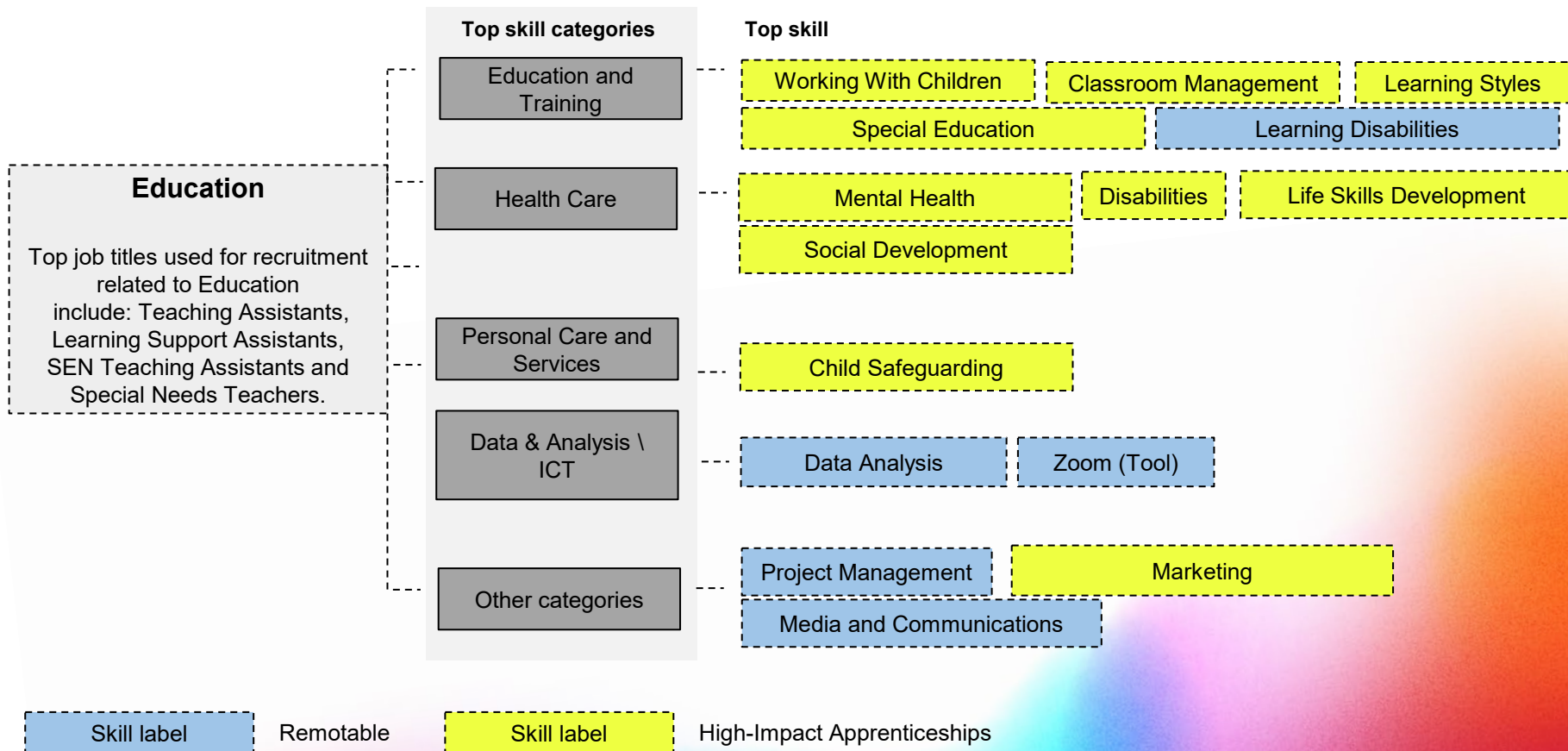
- Selected countries: France, Austria, Denmark, Czech Republic — due their dual systems and recent reforms in inclusive and digital education.

- Targeted subdomains: Special education, early childhood, tutoring, and EdTech - selected through keyword filtering in multiple languages.

- Top occupations: Teacher Assistants, Special Ed Teachers, Curriculum Designers, Preschool Educators.

- Key skills: Autism Spectrum Disorders, Classroom Management, Digital Learning Tools.

Real-world classroom experience is critical for skill development, especially in inclusive education roles.

Figure 6.   **Cyber Security - Job Postings Trends in Europe**

Cyber-Security - Job Postings Trends in Europe

Spain — Netherlands — Luxembourg — Ireland

Skills framework for apprenticeships in the Education sector

Top skill categories

Top skill

Education

Top job titles used for recruitment related to Education include: Teaching Assistants, Learning Support Assistants, SEN Teaching Assistants and Special Needs Teachers.

Education and Training

Working With Children

Classroom Management

Learning Styles

Special Education

Learning Disabilities

Health Care

Mental Health

Disabilities

Life Skills Development

Social Development

Personal Care and Services

Child Safeguarding

Data & Analysis \ ICT

Data Analysis

Zoom (Tool)

Other categories

Project Management

Marketing

Media and Communications

Skill label — Remotable

Skill label — High-Impact Apprenticeships

Conclusions

- **Current systems lag behind in adapting to digital demands and new trends** (evidence in countries like Italy and the UK, where enrolments remain traditional).

- **Framework skill sets** help align training with real-world needs, combining technical, regulatory, and transversal competencies. **Generative AI** and **online job postings data** offer innovative ways to assess apprenticeship suitability (success ratio and remotability).

- Emerging sectors like FinTech, Cybersecurity, and EdTech present strong opportunities for expanding apprenticeship models.

- Policy priority: **Invest in scalable, high-impact apprenticeships tailored to fast-evolving sectors** to tackle talent shortages and support inclusive growth.

Thank you. Any questions?

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