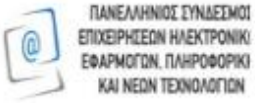

# National Needs Analysis Report

Young Organizers Using Technology for Hybrid Innovative IoT Solutions and Collaborative Tools

YOUTH-IIT





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## Executive Summary

The YOUTH-IIT project is designed to empower young people, including NEETs, migrants and other young people with fewer opportunities, by combining practical Internet of Things learning, entrepreneurial capability, collaborative digital tools and environmentally responsible problem-solving. Work Package 2 requires the consortium to transform a broad project rationale into a defensible learning-design baseline. This report therefore treats needs analysis not as a descriptive preface to curriculum writing, but as a managed service-design activity: evidence is collected from stakeholders, converted into prioritised requirements, translated into modules and learning formats, and then reviewed through feedback and continual improvement.

**The four countries share a strategic need but do not share a starting point.** In 2025 the share of people aged 15–29 who were neither in employment nor in education or training was 13.6% in Greece, 13.8% in Bulgaria, 10.8% in Croatia and 19.2% in Romania, against an EU average of 11.0% and an EU 2030 target of 9.0%. Romania records the highest NEET rate in the Union and the highest rate of early leaving from education and training (15.5% against an EU average of 9.1%). Croatia performs best on both headline indicators, with the lowest early-leaving rate in the EU at 2.1%. Greece has achieved one of the largest ten-year NEET reductions in the Union, from 24.1% in 2015 to 13.6% in 2025. Bulgaria, by contrast, moved in the wrong direction in the most recent year, rising from 12.7% in 2024 to 13.8% in 2025.

**Headline rates conceal the populations the project actually serves.** Greece is the only EU country in which NEET rates are *higher* among tertiary-educated young people (19.1%) than among those with medium (15.4%) or low (6.9%) educational attainment; the Greek problem is therefore one of transition and job matching rather than of educational failure. In Bulgaria and Croatia roughly three quarters of early leavers are not in employment at all. Across all four countries, young mothers, people with low educational attainment, Roma youth, rural youth, recent migrants, refugees, young people with disabilities and those with

weak institutional trust follow different pathways into disengagement and require different responses.

**Digital capacity is uneven, and in several countries it is deteriorating.** In 2025, 60% of people aged 16–74 in the EU had at least basic overall digital skills, against a 2030 target of 80%. The national figures were approximately 51.0% in Greece, 38.3% in Bulgaria, 63.4% in Croatia and 31.8% in Romania. Romania and Bulgaria record the two lowest values in the Union. Greece has been losing ground at approximately 1.4% per year since 2023, and Croatia is among ten Member States whose 2025 result is below its 2022 result. Croatia also records the largest education-related gap in the EU: 67 percentage points separate its highly educated from its low-educated residents. A strong national average therefore cannot be read as evidence that the project's target group is digitally ready.

**The age-specific data are decisive for curriculum design.** Among people aged 16–24, 74.6% in the EU had at least basic digital skills in 2025 – but only 52.8% in Bulgaria and 53.3% in Romania, the only two Member States below 60%. In Greece the picture is markedly better and markedly gendered: 83.5% of young women against 75.3% of young men. This means two things simultaneously. In Bulgaria and Romania, close to half of the target age group lacks even basic digital skills, so a foundation layer is not optional. In Greece and Croatia, most young people clear the basic threshold, so the constraint is not basic skill but the absence of *applied* competence – electronics, data interpretation, structured collaboration and troubleshooting – and the very small ICT specialist base (2.5% of employment in Greece against an EU average of 5.0%).

**These findings support a deliberately layered curriculum.** The programme should not assume that participants are "digital natives" merely because they are young. An initial foundation layer should address digital confidence, online safety, file management, basic data literacy, collaborative behaviour and problem definition. A second layer should explain IoT systems through the simple chain of sensing, connecting, processing, displaying and acting. A third layer should enable hands-on experiments using accessible devices such as Arduino, ESP32 and Micro:bit, with Raspberry Pi offered as an optional extension rather than an entry requirement. A fourth layer should connect prototypes to entrepreneurship: user needs, value propositions, simple costing, business-model choices, sustainability, customer feedback, teamwork and presentation. Environmental use cases – energy monitoring, air quality, soil moisture, temperature and humidity, waste reduction and

responsible resource use – provide the practical narrative that links technology, entrepreneurship and green transition.

**The preferred learning model is blended, modular and practice-led.** Short mobile-friendly content should be combined with live or recorded demonstrations, guided exercises, peer teamwork, case studies, quizzes, reflection prompts and low-risk prototype challenges. The Open eClass environment can support structured learning paths, documents, assignments, self-assessment, forums, questionnaires, multimedia and teleconferencing. Collaborative tools such as Google Forms, Google Drive, Trello and Asana should be used as learning objects and as the operating environment for team projects, not taught as isolated software tutorials.

**Accessibility requires more than technical compliance.** The material should use plain English as the common development language and be translated or locally adapted into Greek, Bulgarian, Croatian and Romanian. Essential instructions should be available in concise text, visual and video formats. Captions, transcripts, alt text, strong colour contrast, keyboard accessibility and downloadable low-bandwidth versions should be standard. Participants with weaker language skills or limited technical confidence need glossaries, examples before abstraction, repeated practice and visible support contacts. Migrants and refugees may additionally require host-language scaffolding, flexible timing and recognition that educational and employment histories do not always transfer cleanly across countries.

**The report follows ITIL 4 in five practical ways.** First, it focuses on stakeholder value: every research question must inform a curriculum, access or delivery decision. Second, it starts where the consortium is, using the approved YOUTH-IIT objectives, partner expertise, existing IoT manuals, the Open eClass platform and available national support systems. Third, it progresses iteratively with feedback: desk research establishes hypotheses, fieldwork tests them, pilot delivery generates further evidence and the curriculum is revised. Fourth, it collaborates and promotes visibility through common questionnaires, a shared codebook, national evidence tables and transparent limitations. Fifth, it treats the programme holistically, ensuring that pedagogy, technology, inclusion, data protection, trainer capacity, cost, platform design and sustainability are considered together.

**A complete field research package is included.** The recommended minimum per country is 30–40 valid questionnaires from young people aged 18–30 and at least five responses from youth workers, trainers or related professionals, with a focus group of six to eight

participants as a supplement or partial substitute where professional recruitment is difficult. Across four countries this yields 120–160 youth responses and at least 20 professional responses. Sampling should deliberately include young people with fewer opportunities rather than relying only on university or technology networks. Data should be collected anonymously or pseudonymously, with a concise privacy notice, voluntary participation, minimal sensitive data and clear storage rules.

**Section 12 makes the results reporting mechanical rather than discretionary.** It provides every table and chart the deliverable requires – participant profile, digital access and confidence, IoT familiarity and tool interest, entrepreneurial confidence, learning-method preference, accessibility and language requirements, practitioner comparison, qualitative themes and the final requirements traceability matrix – with denominators, categories, chart types and reporting rules already fixed. National teams enter cleaned, anonymised data into a prepared structure. Because no primary dataset accompanied this version, those cells remain empty; this report does not claim field findings that have not occurred. The provisional recommendations in Section 13 should be treated as a design baseline that primary evidence must confirm, refine or challenge before final curriculum approval.

# 1. Purpose, Scope and Project Alignment

## 1.1 Purpose of the report

The purpose of the National Needs Analysis Report is to identify, compare and prioritise the learning, access and support needs that should shape YOUTH-IIT educational programmes. It addresses four interconnected questions. What is the situation of young people and youth entrepreneurship in Greece, Bulgaria, Croatia and Romania? What is the level of digital and IoT readiness among the intended target groups? Which barriers affect NEETs, migrants and other young people with fewer opportunities? What educational design choices are most likely to create practical value, sustained engagement and transferable competence?

The report is national and comparative. Each country section describes the local youth and labour-market context, entrepreneurship environment, digital and IoT capability, inclusion barriers, educational opportunities and gaps. The comparative section identifies common requirements that justify a shared transnational curriculum and national adaptations that should remain visible in recruitment, language support, facilitation and examples. The objective is not to rank countries. It is to avoid a one-size-fits-all learning service that is either too elementary for some participants or inaccessible to others.

## 1.2 Alignment with the approved YOUTH-IIT application

The approved application defines WP2 as Research – Creation of Educational Programs – Manual – Instruction. It requires a comprehensive needs analysis focused on gaps in IoT and entrepreneurial skills, particularly among young people with fewer opportunities. The research is intended to guide targeted content on IoT sensors, energy efficiency, environmental protection, business development with IoT and collaborative tools including Google Sites, Google Forms, Google Maps, Google Drive, Trello and Asana. Training should be delivered through an accessible e-learning platform supported by quizzes, videos, case studies and inclusive facilitation.

The main planned result is a needs analysis covering all partner countries and identifying gaps in entrepreneurial and IoT education, especially for NEETs and migrants. This report is therefore an upstream control document for subsequent outputs. Its recommendations should be traceable into educational-programme specifications, manuals, platform structures, pilot-testing criteria and evaluation indicators. A finding that does not influence a decision has limited operational value; conversely, a curriculum decision that cannot be linked to evidence should be treated as an assumption requiring pilot validation.

| **Project requirement** | **Implication for this report** |
|---|---|
| Empower young people with fewer opportunities | Sampling and analysis must include barriers, not only average youth indicators. |
| Develop IoT and entrepreneurship competence | Needs must be translated into technical, business and transversal learning outcomes. |
| Use collaborative digital tools | The research process and curriculum should test purposeful teamwork, not software familiarity alone. |
| Promote environmental sustainability | National examples and practical projects should link sensors and data to energy, waste and environmental monitoring. |
| Provide multilingual, accessible learning | Language, mobile access, low bandwidth, disability access and trainer support must be treated as design requirements. |
| Apply ITIL 4 principles | Evidence, ownership, quality gates, feedback loops and continual improvement must be explicit. |

## 1.3 Target groups

The primary target group is young people aged approximately 18–30, with particular attention to young entrepreneurs, potential entrepreneurs and those who could use digital and IoT skills to improve employability, civic participation or community problem-solving. The inclusion lens covers NEETs, unemployed and

inactive young people, migrants and refugees, young people from rural or geographically isolated areas, people with low income, young people with low educational attainment, Roma youth, people with disabilities and individuals facing social, family or language barriers.

The secondary target group comprises youth workers, trainers, career counsellors, employment advisers, NGO staff, educators, mentors, technology facilitators and other professionals who understand the daily barriers faced by young people. Their input is essential because self-assessment by learners can understate hidden barriers or overstate confidence. Practitioners can also assess trainer readiness, organisational capacity, recruitment challenges, safeguarding, digital access and the feasibility of specific learning formats.

### 1.4 Compliance with the deliverable specification

The National Needs Analysis Report must satisfy a defined set of requirements. Traceability between those requirements and the content of this document is itself a quality control: an unmapped requirement is a gap, and unmapped content is scope that has not been justified. The table below therefore serves both as a reading guide and as the acceptance checklist for the WP2 quality gate.

| Required element | Where it is delivered | Status |
|---|---|---|
| Literature and national research on the situation of young people and youth entrepreneurship in each country | Sections 4–8; national source tables in §5.7, §6.7, §7.7 and §8.7 | Complete. All comparative indicators verified against Eurostat and European Commission publications to August 2026. |
| Level of digital and IoT skills | §4.2 and §5.2, §6.2, §7.2, §8.2 | Complete, and strengthened in Version 2.0 by the addition of age-specific (16–24) digital-skills data. |

| Required element | Where it is delivered | Status |
|---|---|---|
| Needs of NEETs, migrants and young people with fewer opportunities | §4.4 and §5.3, §6.3, §7.3, §8.3; learner profiles in §9.4 | Complete for desk evidence; perceived needs to be confirmed by fieldwork (§12.3, §12.7). |
| Available educational opportunities and existing gaps | §5.4, §6.4, §7.4 and §8.4 | Complete. Presented as paired opportunity/gap tables. |
| Field research with young people and youth professionals | Sections 3 and 11; Appendices A–D | Instruments, protocol, sampling rules and ethics complete. Execution pending. |
| Presentation of results in tables or charts | Section 12 | Framework complete: all tables, chart types and denominators specified. Data cells empty pending fieldwork. |
| Conclusions on module topics | §10.1 and §13.1 | Provisional recommendation issued; confirmation requires §12.4 and §12.5. |
| Conclusions on level of difficulty | §10.2 and §13.2 | Provisional; requires the diagnostic results in §12.3. |
| Conclusions on preferred learning methods | §10.3 and §13.3 | Provisional; requires §12.6. |
| Conclusions on accessibility needs | §10.4 and §13.4 | Strong desk evidence; individual accommodation data from §12.7. |
| Conclusions on language and format of materials | §10.5 and §13.5 | Strong desk evidence; confirmation from §12.7. |

| Required element | Where it is delivered | Status |
|---|---|---|
| Conclusions on the practical IoT tools of greatest interest | §10.6 and §13.6 | Provisional; requires the tool-interest results in §12.5 and the feasibility assessment in §12.8. |
| Minimum sample: 30–40 young people and 5 professionals per country | §3.2, §11.1 and the dashboard in §11.3 | Methodological requirement fixed and monitored. |
| Minimum 3–5 credible national or European sources per country | §5.7, §6.7, §7.7, §8.7 and Appendix E | Complete. Each national chapter carries its own source table with a quality and limitation note. |
| ITIL 4 approach | Section 2 | Applied throughout: value streams, guiding principles, four dimensions, quality gates and continual improvement. |

Two requirements deserve particular comment. First, the specification asks for field research *and* for the presentation of its results. These are separable deliverable components with different dependencies: the research design can be completed and approved in advance, whereas the results cannot exist before collection. Version 2.0 therefore separates Part A from Part B rather than blurring the two, which allows the consortium to approve and use the design work immediately without implying that empirical findings are already available.

Second, the requirement for a minimum number of credible sources per country is a quality floor, not a target. Four to six well-chosen sources per country – typically one comparative statistical source, one European policy assessment, one national policy description and one or two national or sectoral sources – produce a more defensible analysis than a long list of overlapping references. Each national source table therefore states not only what the source contributes but where it should not be relied upon.

## 2. ITIL 4 Framework for Needs Analysis

### 2.1 Needs analysis as a service value stream

ITIL 4 describes service management as a set of organisational capabilities for enabling value through services. Applied to YOUTH-IIT, the learning programme is a service system rather than a collection of documents. Young people, trainers, partner organisations, employers, community stakeholders and programme authorities co-create value. The needs analysis is the first controlled value stream in which stakeholder conditions and national evidence are converted into a learning-design baseline.

The value stream begins with demand and opportunity. Demand is visible in NEET rates, digital-skill gaps, weak SME adoption of advanced technology, barriers affecting migrants and rural youth, and the need for sustainable entrepreneurship. Opportunity is visible in affordable microcontrollers, open-source learning platforms, youth-work networks, national employment programmes, EDIHs, vocational training and EU funding. The value stream then moves through engagement, research design, evidence collection, analysis, prioritisation, curriculum design, validation and continual improvement.

| Value-stream stage | Main input | Controlled output | Primary ITIL practices |
|---|---|---|---|
| Engage | Project objectives, stakeholders, national partner networks | Stakeholder map, recruitment plan, agreed questions | Relationship management; business analysis |
| Plan | Research purpose, countries, target groups, constraints | Methodology, sample targets, ethics and quality plan | Project management; risk management |
| Obtain evidence | Desk sources, questionnaires, | Traceable evidence repository and | Knowledge management; |

| Value-stream stage | Main input | Controlled output | Primary ITIL practices |
|---|---|---|---|
| | interviews, focus groups | response dataset | information security |
| Analyse | Cleaned quantitative and qualitative evidence | Country findings, cross-country patterns, confidence notes | Measurement and reporting; business analysis |
| Design | Prioritised needs and constraints | Module architecture, formats, access requirements, tool choices | Service design; change enablement |
| Improve | Pilot feedback, platform analytics, trainer observations | Corrective actions, updated content and lessons learned | Continual improvement; monitoring and event management |

## 2.2 Application of the seven ITIL 4 guiding principles

Focus on value means asking whether each item of evidence can influence participant outcomes. Questions about preferred learning methods, for example, are valuable only if the consortium is prepared to adjust delivery. A long survey that collects interesting but unused demographic detail creates burden rather than value. Value is multidimensional: participants seek confidence, employability and meaningful practice; trainers need usable materials; partners need deliverable quality and audit evidence; the programme needs inclusion and European added value.

Start where you are means using existing assets before creating new complexity. The consortium already has an approved project rationale, a defined target of 200 young people, partner outreach networks, an Open eClass platform, ITIL-aligned project-management

guidance, IoT manuals covering Arduino, ESP32, Micro:bit and Raspberry Pi, and collaborative-tool content. The needs analysis should test how these assets fit national conditions rather than restarting from a blank page.

Progress iteratively with feedback means using desk research as a first hypothesis, fieldwork as a validation stage and pilot delivery as a second evidence cycle. A curriculum should be released in manageable versions. Early modules can be tested with a small group, revised, translated and then expanded. Feedback should lead to named actions, deadlines and closure evidence; otherwise, “iteration” becomes a slogan.

Collaborate and promote visibility means that national partners use common core questions, a shared codebook, transparent sampling records and visible limitations. Country teams should be able to see response counts, missing target groups, translation issues and data-quality concerns while fieldwork is still active. Problems raised early should be treated as professional control, not as criticism.

Think and work holistically means testing recommendations against the whole learning system. Choosing ESP32 because it is technically attractive is not enough; the consortium must consider cost, availability, trainer competence, software installation, language, safety, internet access, mobile compatibility and the ability to complete a meaningful project. Likewise, a polished LMS is not inclusive if registration, navigation or assignment submission excludes low-confidence users.

Keep it simple and practical means limiting the core questionnaire to questions that support decisions, using clear wording, offering examples and avoiding technical jargon. It also means designing modules around observable tasks: connect a sensor, read a value, interpret data, collaborate on a board, define a user problem, explain a value proposition and present a simple prototype.

Optimise and automate means standardising before automating. The consortium should first agree on variable names, response codes, country identifiers, file names and version control. It can then use Google Forms or Open eClass questionnaires, spreadsheet validation, automated charts and dashboards. Automation should reduce administrative friction without obscuring data quality or excluding participants who need assisted completion.

### 2.3 ITIL 4 dimensions of service management

| Dimension | Needs-analysis focus | Key questions |
|---|---|---|
| Organisations and people | Young people, trainers, partners, roles, confidence and support | Who needs the service? Who facilitates it? Who owns decisions and escalation? |
| Information and technology | Survey tools, LMS, devices, data, security and accessibility | What information is necessary? Which technology is usable and proportionate? |
| Partners and suppliers | Consortium partners, youth organisations, employment services, training providers | Which networks can recruit target groups and sustain the learning pathway? |
| Value streams and processes | From evidence to curriculum, pilot, evaluation and improvement | How does each finding become a requirement, action and accepted output? |

## 3. Research Methodology and Quality Controls

### 3.1 Mixed-method design

The methodology combines comparative desk research with primary field research. Desk research establishes the national context, available programmes, structural barriers and measurable gaps. Field research captures perceptions, motivations, self-assessed skills, practical interests and access needs that are not visible in national statistics. The two evidence streams should be triangulated. A high national digital-skills score does not guarantee that a recruited NEET participant can use a learning platform confidently. Conversely, low national averages do not mean that every participant needs the same introductory content.

The desk-research component prioritises authoritative and comparable sources: Eurostat, European Commission Digital Decade country reports, Education and Training Monitor country analyses, Youth Wiki national-policy descriptions, Eurofound, OECD, UNHCR and national public-employment or training authorities. Sources are selected for relevance, recency, methodological clarity and national coverage. Where definitions differ—for example, youth may refer to ages 15–24, 15–29 or 18–34—the report states the relevant age group and avoids false precision.

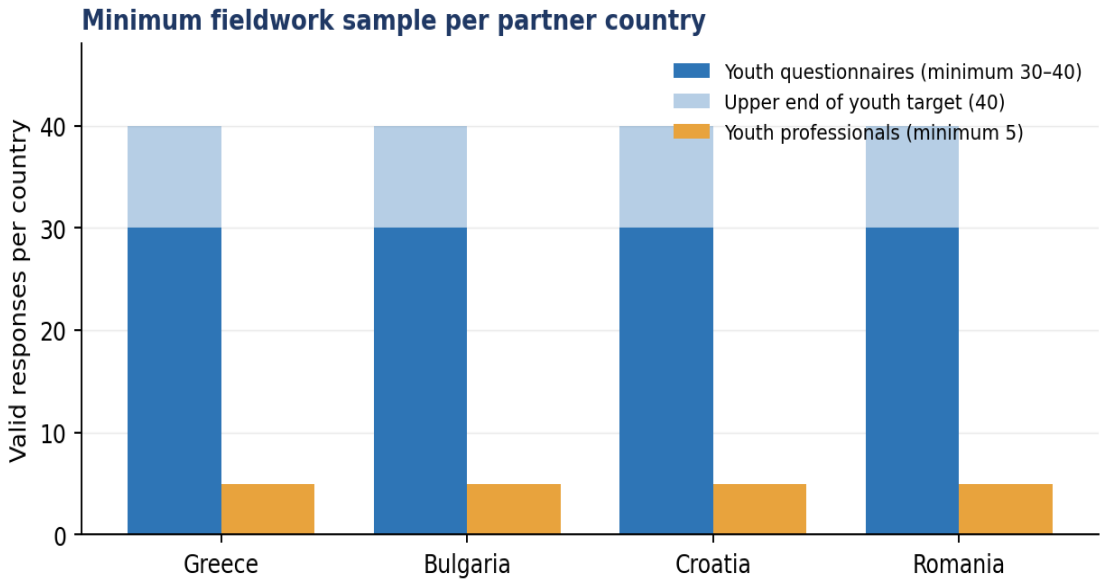
The primary component uses a common questionnaire for young people, a shorter questionnaire for practitioners and optional focus groups. The questionnaire should be available online and, where required, in assisted paper or facilitated digital form. The common core should remain identical across countries, while a small national section can capture local programmes, language or context. Translation should use forward translation, review by a second speaker and a short cognitive test with two or three potential respondents.

### 3.2 Sample and recruitment

A practical minimum is 30–40 valid youth questionnaires per country and at least five practitioner responses. Across four countries, this would produce 120–160 youth responses and at least 20 professional responses. This is not a statistically representative national survey; it is a structured project needs assessment. Its

credibility depends less on a large convenience sample and more on deliberate diversity, transparent recruitment and consistent instruments.

Each country should recruit beyond universities and existing technology communities. At minimum, the sample should include a mix of employed, unemployed, student and NEET respondents; people with and without prior entrepreneurship experience; urban and non-urban residents; and, where ethically and operationally feasible, migrants, refugees, young people with disabilities and other groups facing barriers. Partners should record recruitment channels and monitor over-concentration. If 90% of responses come from ICT students, the findings cannot be used as evidence for the broader target group without qualification.




*Bar chart showing a recommended minimum of 30 to 40 youth questionnaire responses and at least five practitioner responses in each partner country.*

**Figure 1. Recommended minimum fieldwork sample per partner country. A focus group of 6–8 participants may supplement or partially substitute the professional questionnaire.**

### 3.3 Survey themes

| Theme | Examples of variables | Decision supported |
|---|---|---|
| Profile and current | Age, country, labour status, | Recruitment reach and |

| Theme | Examples of variables | Decision supported |
|---|---|---|
| situation | education, location, fewer-opportunity self-identification | subgroup analysis |
| Digital access | Device, internet reliability, data cost, quiet study space, platform confidence | Delivery format, low-bandwidth options and support |
| Digital competence | File handling, collaboration, data, safety, troubleshooting, content creation | Foundation-module level |
| IoT awareness and experience | Familiarity with sensors, boards, coding, dashboards and environmental applications | Technical starting point and device selection |
| Entrepreneurial competence | Problem identification, customer needs, budgeting, teamwork, pitching, confidence | Entrepreneurship module priorities |
| Learning preferences | Video, live workshop, self-paced, peer work, project challenge, mentoring | Instructional design and scheduling |
| Accessibility and language | Reading level, translation, captions, disability access, language confidence | Format, localisation and accommodation |
| Motivation and barriers | Time, transport, anxiety, cost, certification, employer relevance | Engagement and retention strategy |

### 3.4 Data protection, safeguarding and research ethics

Data collection should follow data-minimisation and purpose-limitation principles. The needs analysis does not require names, exact addresses, identity documents or detailed migration histories. A participant code, country and broad demographic

variables are sufficient for analysis. The privacy notice should explain the project, voluntary participation, intended use, storage period, contact point and right to withdraw before anonymised aggregation.

Sensitive categories should be collected only where necessary and preferably through a non-exclusive, optional question about barriers or fewer-opportunity circumstances. Respondents must be able to choose “prefer not to say”. Free-text fields should warn participants not to enter identifying information. Focus groups require particular care because confidentiality can be requested but not fully guaranteed among participants; facilitators should agree ground rules and avoid probing traumatic experiences.

Data access should be role-based. National partners may retain identifiable contact information for scheduling only in a separate file, while the analytical dataset should contain no direct identifiers. The shared consortium dataset should be anonymised, with version control and an agreed retention schedule. Any quotations used in the final report should be paraphrased or checked for re-identification risk.

### 3.5 Analysis plan

Quantitative analysis should begin with completeness, duplicates, implausible response patterns and translation consistency. Core variables should be coded identically across countries. Results should be reported as counts and percentages, with the denominator stated when questions are optional. Because samples are modest and non-probabilistic, differences should be described as patterns rather than national population estimates.

Useful comparisons include country, labour status, prior IoT experience, level of education, urban/rural location and fewer-opportunity status. Composite scores may be constructed for digital confidence, IoT readiness and entrepreneurial confidence, provided the scoring rule is documented and internal consistency is checked. A five-point self-rating is not proof of competence; it should be interpreted alongside task familiarity and qualitative responses.

Qualitative analysis should use a shared thematic codebook. At least two reviewers should code a subset of responses to calibrate interpretation. Themes should capture barriers, motivations, preferred formats, practical project ideas, accessibility needs, trust and

support. Negative cases are important: a minority reporting serious access or language barriers may justify an accommodation even when the average response is positive.

### 3.6 Quality gates and limitations

| Quality gate | Acceptance criteria | Evidence |
|---|---|---|
| Instrument approval | Questions map to decisions; privacy notice included; language reviewed | Approved questionnaire version and review note |
| Pilot test | At least 2–3 test respondents per language; confusing items corrected | Pilot log and version change record |
| Fieldwork readiness | Recruitment channels and target quotas documented | National fieldwork plan |
| Data acceptance | Duplicates, missingness and outliers reviewed; country coding consistent | Clean-data log |
| Analysis acceptance | Tables reproducible; quotations anonymised; limitations stated | Analysis workbook and reviewer sign-off |
| Report acceptance | Recommendations traceable to evidence and classified as observed, inferred or provisional | Requirements traceability matrix |

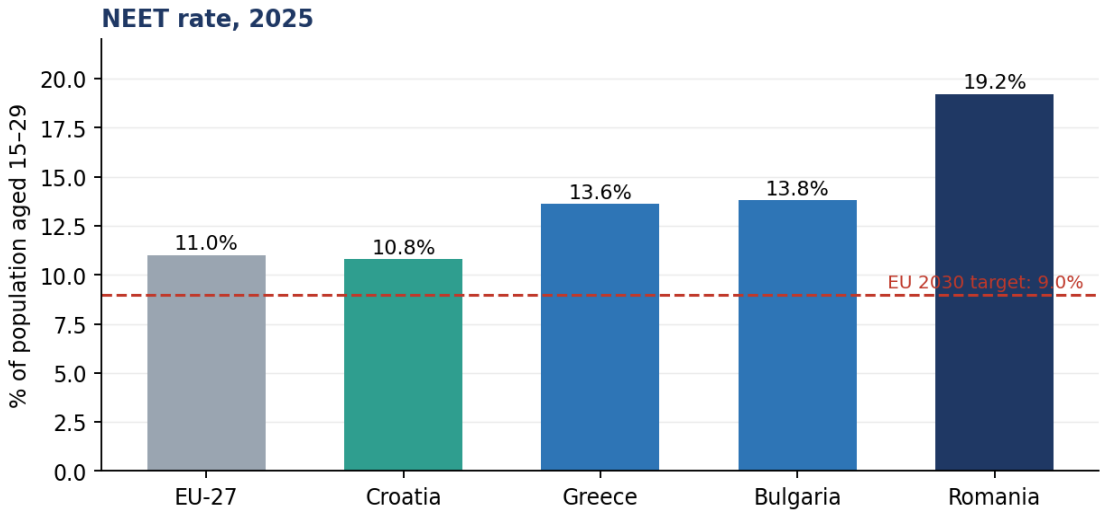
**Primary limitation of the current version** | | No raw fieldwork dataset was available during preparation of this | version. All tables and figures in Sections 4–10 derive from project documents and verified external desk research; none is presented as a response from a YOUTH-IIT participant. The result tables in Section 12 are supplied complete but empty, and must be populated from cleaned anonymised data before the report is issued as final.

## 4. European Comparative Context

### 4.1 Youth transition and NEET risk

The EU has set a 2030 ambition to reduce the share of young people aged 15–29 who are neither in employment nor in education or training to 9.0%. In 2025 the EU rate was 11.0%, its lowest recorded level. All four YOUTH-IIT countries therefore operate within a policy environment that prioritises activation, skills, inclusion and smoother transitions from education to work, and all four sit within the group of ten Member States that remain above the EU average or close to it.

The country values diverge sharply. Croatia, at 10.8%, was marginally below the EU average. Greece (13.6%) and Bulgaria (13.8%) were above it. Romania, at 19.2%, recorded the highest NEET rate in the Union – approaching one young person in five, and more than three and a half times the rate of the best performer, the Netherlands (5.3%).




*Bar chart comparing 2025 NEET rates for people aged 15 to 29: EU 11.0 percent, Croatia 10.8, Greece 13.6, Bulgaria 13.8 and Romania 19.2, with the EU 2030 target line at 9 percent.*

**Figure 2. NEET rates in the four partner countries and the EU, 2025. Source: Eurostat, dataset edat_lfse_20 (news release of 28 May 2026).**

The ten-year trend matters as much as the level, because it indicates whether a national system is already correcting itself or whether external intervention carries more weight. Between 2015 and 2025 the NEET rate fell in 22 of 27 Member States. Two of the three largest reductions in the entire Union were recorded in YOUTH-IIT countries: Greece fell by 10.5 percentage points, from 24.1% to 13.6%, and Croatia by 9.0 points, from 19.8% to 10.8%. Bulgaria also fell substantially over the decade, from 22.2% in 2015, but the most recent movement was adverse: the Bulgarian rate rose from 12.7% in 2024 to 13.8% in 2025, moving the country from sixth to second highest in the Union. Version 1.0 of this report treated all four national trajectories as broadly improving; that reading is not supported by the 2025 data for Bulgaria and should not be repeated in dissemination material.

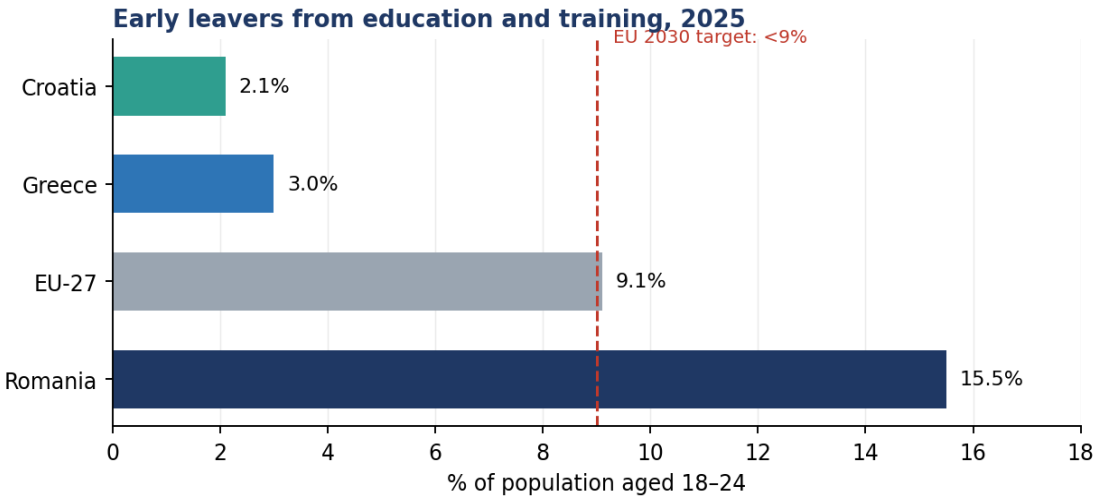
NEET status is a heterogeneous outcome, and the aggregate figure is a poor guide to who the participants will actually be. Some young people are actively unemployed and job-seeking; others are outside the labour force because of care responsibilities, illness, discouragement, disability, migration disruption or the absence of accessible services. Within the 15–29 band the risk rises steeply with age: only 5.3% of those aged 15–19 were NEET in the EU in 2025, compared with 12.8% of those aged 20–24 and 14.7% of those aged 25–29. Since YOUTH-IIT recruits from 18 to 30, the project is working almost entirely in the higher-risk part of the distribution, and the relevant national rates are in practice above the headline figures quoted above.

Educational attainment is normally the strongest single predictor of NEET status, but the relationship is not uniform, and one of the exceptions is directly relevant to this project. In 2025, low-educated young people recorded the highest NEET rates in almost every Member State. Greece was the clearest exception in the Union: 19.1% of tertiary-educated young Greeks were NEET, against 15.4% of those with medium and 6.9% of those with low educational attainment. Croatia is among the small group of countries showing a similar inversion. This has a direct design consequence. In Greece, and to a lesser degree in Croatia, a substantial share of disengaged young people hold qualifications and will not be served by remedial content; they need applied practice, portfolio evidence and labour-market connection. In Bulgaria and Romania the conventional pattern holds, and foundational provision is genuinely necessary.

Eurofound research emphasises that formal education, gender, region and family responsibilities shape NEET risk in combination rather than individually. Digital learning can improve access, but it cannot substitute for labour demand, childcare, transport, documentation, language support or trusted outreach. YOUTH-IIT should therefore position training as one component of a broader pathway and connect participants with relevant national services wherever possible.

### 4.2 Early leaving and the education-to-work interface

Early leaving from education and training provides the second structural indicator and separates the four countries more sharply than any other. In 2025, 9.1% of people aged 18–24 in the EU had completed at most lower secondary education and were not in further education or training. Across the Union the range ran from 2.1% in Croatia – the lowest value in the EU – to 15.5% in Romania, the highest. Greece, at 3.0%, was the second-lowest performer in the Union.




*Horizontal bar chart of early leavers from education and training in 2025: Croatia 2.1 percent, Greece 3.0, EU 9.1 and Romania 15.5, with the EU 2030 target line at 9 percent.*

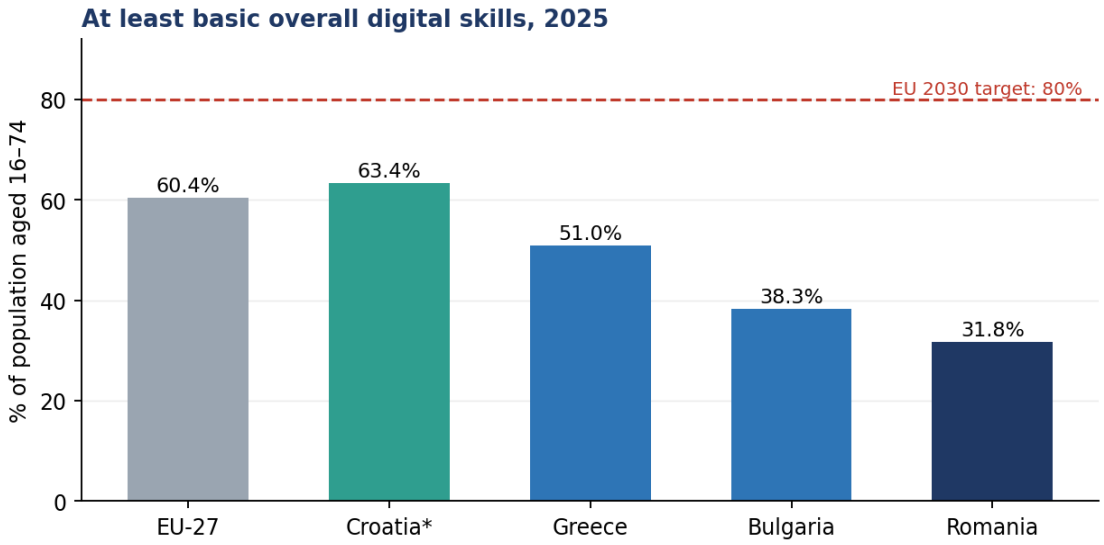
**Figure 3. Early leavers from education and training, 2025. Source: Eurostat, dataset edat_lfse_14 (news release of 4 June 2026).**

The contrast between Figures 2 and 3 is the most important analytical finding in this chapter. Greece has almost eliminated early school leaving yet retains a NEET rate well above the EU average; Romania combines the worst outcomes on both indicators. Croatia performs strongly on both. The two indicators therefore diagnose different problems, and the same curriculum cannot address them identically. Greece's difficulty lies at the interface between completed education and the labour market. Romania's difficulty begins earlier, inside the education system itself, and compounds afterwards.

Employment status among early leavers reinforces the point. In 2025 only nine Member States reported that half or more of their early leavers were in employment. Bulgaria (76.7% not employed) and Croatia (76.2% not employed) were among the four countries with the highest non-employment shares in the Union. Where a young person leaves education early in these two countries, the probability of remaining outside work is very high, and a short training intervention will not by itself change that. This argues strongly for the signposting and referral component recommended in §10.10 rather than for treating YOUTH-IIT as a self-contained pathway.

### 4.3 Digital skills and the advanced-skills gap

The Digital Decade target is for at least 80% of people aged 16–74 to have at least basic overall digital skills by 2030. In 2025 the EU value was 60%, twenty percentage points short, and only four Member States – the Netherlands (84%), Ireland (83%), Denmark and Finland (both 81%) – had already passed the target. Three of the four YOUTH-IIT countries were below the EU average, and the two lowest values in the entire Union were recorded in partner countries: Romania (31.8%) and Bulgaria (38.3%). Greece stood at approximately 51.0% and Croatia at approximately 63.4%.



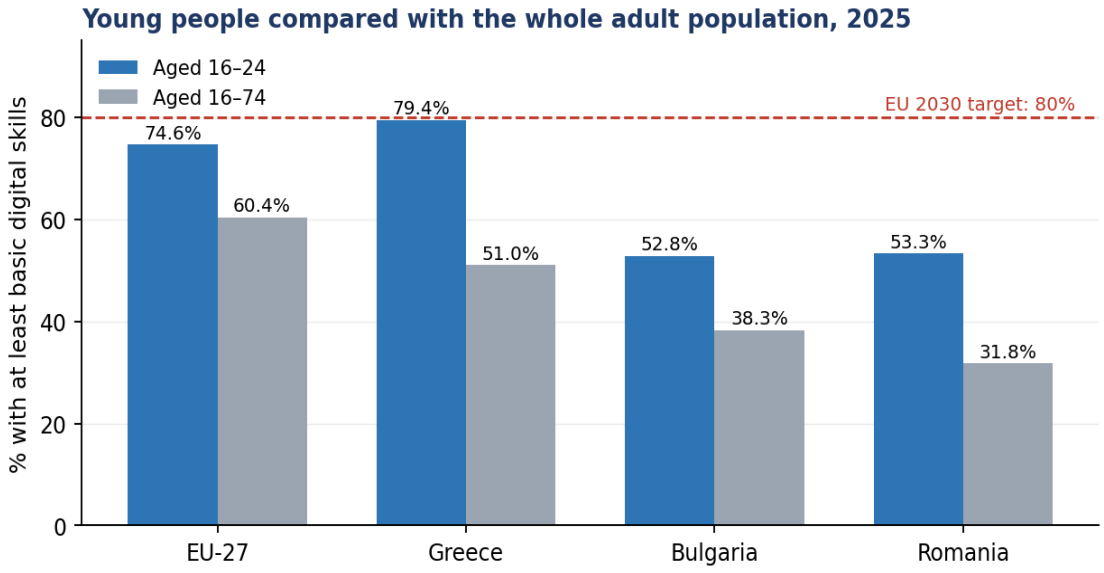

*Bar chart comparing 2025 basic digital skills for people aged 16 to 74: EU 60.4 percent, Croatia 63.4, Greece 51.0, Bulgaria 38.3 and Romania 31.8, with the EU 2030 target line at 80 percent.*

**Figure 4. Share of people aged 16–74 with at least basic overall digital skills, 2025. Source: Eurostat, dataset isoc_sk_dskl_i21, and Digital Decade country reporting. *The most recent comparable value published for Croatia in its Digital Decade country report was for 2023; the figure should be treated as indicative rather than as a confirmed 2025 observation.**

Two trend observations correct the reading in Version 1.0. First, Greece is not improving on this indicator: Digital Decade reporting records an annual decline of approximately 1.4% since 2023. Second, Croatia is one of ten Member States whose 2025 share of adults with at least basic digital skills is *lower* than its 2022 share. Neither country can therefore be described as being on a convergence path towards the 80% target, and neither national figure should be used in project communication as evidence that the target group is digitally prepared.

The general population figure is nevertheless the wrong denominator for a youth project, and Version 2.0 corrects this by introducing the age-specific data published by Eurostat in July 2026. In 2025, 74.6% of people aged 16–24 in the EU had at least basic digital skills. Only two Member States fell below 60%, and both are YOUTH-IIT partners: Bulgaria (52.8%) and Romania (53.3%). In Greece the youth figure is far stronger and strongly

gendered – 83.5% among young women against 75.3% among young men, one of the larger gender gaps in the Union in favour of women. Romania shows the reverse pattern, with young men (55.1%) ahead of young women (51.1%) by four percentage points, the second-largest reverse gap in the EU.




*Grouped bar chart comparing basic digital skills in 2025 for people aged 16 to 24 and 16 to 74 in the EU, Greece, Bulgaria and Romania, with the EU 2030 target line at 80 percent.*

**Figure 5. Basic digital skills among young people compared with the whole adult population, 2025. Source: Eurostat, dataset isoc_sk_dskl. The Greek youth value is derived from the published male and female shares. Croatia is omitted because a 2025 youth value was not published at the data cut-off.**

The design implication is unambiguous and differs by country. In Bulgaria and Romania roughly half of the target age group does not meet even the basic threshold, so an assisted foundation layer is a precondition for participation rather than an optional preliminary. In Greece and Croatia the great majority of young people clear the basic threshold, so a mandatory beginner track would waste their time and risk disengagement; the binding constraint there is the absence of *applied* competence.

Education level, not age, is the dominant fault line. Across the EU in 2025 the share with at least basic digital skills ranged from 82% among the highly educated to 38% among those with no or low formal education. The largest gap in the entire Union was recorded in

Croatia, at 67 percentage points, followed by Portugal (63) and Malta (62). Croatia's comparatively strong average therefore conceals the sharpest internal division of any partner country, which is precisely the division that determines whether a young person with fewer opportunities can use an e-learning platform. A national average is not an admission criterion.

The advanced end of the distribution is equally constrained. Eurostat recorded ICT specialists as 2.6% of total employment in Greece and 2.9% in Romania in 2024, the two lowest shares in the Union against an EU average of about 5%; Digital Decade reporting puts the Greek figure at 2.5% for 2025. Young people in these countries have limited access to technically skilled mentors, employers or peer communities outside a few metropolitan clusters. Where YOUTH-IIT can supply structured technical facilitation, it is supplying something the national market does not readily provide.

IoT learning requires several competence layers: basic device and file management; understanding of data and privacy; logical sequencing; physical assembly; safe use of components; coding or configuration; interpretation of sensor outputs; and communication of a practical use case. Participants can fail at any interface even when they are confident at another, and confidence with social media or smartphones does not predict success at any of them. The programme therefore needs diagnostic entry tasks and optional support rather than a single assumed starting level. This is the empirical basis for the layered architecture recommended in Section 10.

### 4.4 Entrepreneurship, green transition and collaborative work

Youth entrepreneurship can provide autonomy, innovation and local value creation, but it is not a universal solution to unemployment. Young entrepreneurs often face limited capital, weak networks, insufficient market knowledge, administrative complexity and unstable income. Training should therefore combine encouragement with realistic risk awareness. Participants need to understand customer problems, evidence, pricing, budgeting, intellectual property, data protection, procurement, partnerships and the difference between a prototype and a sustainable service.

The green transition creates relevant problem domains for IoT: monitoring energy consumption, water use, indoor air quality, soil moisture, temperature, waste levels and equipment performance. These use cases are pedagogically strong because they generate visible data and connect technology to social value. Nevertheless, environmental benefit should not be assumed. Devices consume energy, require materials and create electronic waste. A responsible module should include lifecycle thinking, data minimisation, repairability and the question of whether a connected solution is proportionate to the problem.

Collaborative competence is a labour-market and entrepreneurship skill in its own right. Young people may use messaging applications frequently but still lack habits of task ownership, file naming, version control, meeting decisions, feedback and escalation. YOUTH-IIT should explicitly teach communication, coordination and co-creation. Trello and Asana can make work visible; Google Forms can support needs and customer research; shared documents can capture decisions; and Google Sites can present a project. The learning objective is disciplined collaboration, not tool branding.

### 4.5 Migrants, refugees and young people with fewer opportunities

Migration and displacement can interrupt education, recognition of qualifications, employment history and social networks. The EU continued to host millions of people under temporary protection from Ukraine through 2025 and into 2026, with women and minors forming a large share. UNHCR evidence highlights persistent barriers involving host-country language, documentation, employment, accommodation, educational enrolment, disability and the burden of parallel learning systems.

For YOUTH-IIT, migrant inclusion requires practical design choices: clear eligibility information; local-language outreach; English that does not assume academic fluency; flexible scheduling; recognition of prior skills; examples that do not depend on national administrative knowledge; and referral to specialised services where needed. It is also important not to treat migrants as a single deficit group. Some participants may have strong technical or entrepreneurial backgrounds but need language, credential or network support. A learner may need language support while being technically advanced, and the diagnostic must be capable of detecting that combination.

### 4.6 Labour shortages, job quality and the green–digital transition

European labour shortages create opportunities for young people, but they do not remove the need for targeted preparation. Shortages are uneven by sector, occupation and region, and entry jobs may still require evidence of reliability, communication and technical problem-solving. A learner who can demonstrate a small sensor project, explain the data, document a team process and reflect on errors has a stronger employment narrative than a learner who has only completed passive online content. YOUTH-IIT should therefore treat the final portfolio as a bridge to employment and further training, not merely as an internal assessment object.

Job quality must remain visible. Digital and platform work can offer flexibility but can also involve insecurity, irregular hours and weak progression. Entrepreneurship can be empowering, yet necessity-driven self-employment may transfer risk to young people without adequate protection. Training should explain the difference between an experiment, a freelance service, a start-up and a scalable business. It should also encourage participants to evaluate employment, self-employment and social-enterprise routes according to their goals, resources and risk tolerance.

The twin green and digital transitions create demand for skills that cross traditional disciplinary boundaries. Environmental monitoring requires an understanding of physical conditions, sensors, data quality and user decisions. Sustainable business requires costing, lifecycle thinking, stakeholder engagement and responsible claims. Collaborative delivery requires documentation and coordination. The programme should make these connections explicit so that participants do not see “green”, “digital” and “entrepreneurship” as separate policy labels.

The educational value of environmental IoT depends on disciplined interpretation. A temperature or humidity reading is not meaningful until the learner understands sensor range, placement, sampling interval, calibration, uncertainty and the action linked to the data. A dashboard can create false confidence if the underlying data are unreliable. Modules should therefore introduce simple data-quality questions: Is the reading plausible? Is the sensor placed correctly? What comparison is needed? What decision will change? Who could be harmed by an incorrect conclusion?

A further European issue is the gap between technology supply and local adoption. Countries may have connectivity, research institutions or ICT graduates while SMEs and community organisations still use limited advanced technology; the Digital Decade country reports identify exactly this pattern in all four partner countries. YOUTH-IIT can help address this "last-mile" capability gap by teaching young people to translate technical possibilities into understandable, low-cost and proportionate solutions. This translation role is particularly valuable for small businesses and non-technical organisations that cannot employ full-time ICT specialists, and it is a more realistic employment proposition for most participants than becoming an ICT specialist.

### 4.7 Summary of verified comparative indicators

| **Indicator (2025 unless stated)** | **EU** | **Greece** | **Bulgaria** | **Croatia** | **Romania** |
|---|---|---|---|---|---|
| NEET rate, 15–29 | 11.0% | 13.6% | 13.8% | 10.8% | 19.2% |
| Change in NEET rate, 2015–2025 | n/a | −10.5 pp | −8.4 pp | −9.0 pp | Limited change |
| Early leavers, 18–24 | 9.1% | 3.0% | Above EU average | 2.1% | 15.5% |
| At least basic digital skills, 16–74 | 60.4% | 51.0% | 38.3% ( | 63.4% 2023) | 31.8% |
| At least basic digital skills, 16–24 | 74.6% | ≈79% | 52.8% p | Not ublished | 53.3% |
| ICT specialists, % of employment | ≈5.0% | 2.6% | n/a | n/a | 2.9% |

| Indicator (2025 unless stated) | EU | Greece | Bulgaria | Croatia | Romania |
|---|---|---|---|---|---|
| (2024) | | | | | |
| Position relative to EU average | – | Below on both skills measures | Below on both measures b N | Above on digital skills, elow on EET trend | Lowest in EU on both measures |

*Sources: Eurostat datasets edat_lfse_20, edat_lfse_21, edat_lfse_14, isoc_sk_dskl_i21, isoc_sk_dskl and isoc_sks_itspt; European Commission Digital Decade country reporting. Cells marked "n/a" or "not published" were not available in comparable form at the data cut-off and should not be estimated.*

## 5. National Analysis: Greece

Greece combines a distinctive youth-transition profile with a specific digital and entrepreneurship ecosystem. In 2025 the NEET rate for people aged 15–29 was 13.6%, the share of early leavers from education and training was 3.0% – the second-lowest in the Union – and the share of people aged 16–74 with at least basic overall digital skills was approximately 51.0%. Among young people aged 16–24 the digital-skills picture is considerably stronger, at 83.5% for women and 75.3% for men. Greece has achieved one of the largest NEET reductions in the EU over the past decade, but it is the only Member State where NEET rates are higher among tertiary-educated young people (19.1%) than among those with medium (15.4%) or low (6.9%) attainment, and its basic digital skills have been declining by approximately 1.4% per year since 2023. The Greek problem is therefore one of transition, matching and applied capability rather than of educational failure. The national analysis below separates headline performance from the barriers experienced by the YOUTH-IIT target groups and converts the findings into learning-service implications.

### 5.1 Situation of young people and youth entrepreneurship

Greece's youth labour market has improved from the crisis years, but the transition from education to stable employment remains difficult. The NEET rate is above the EU average, youth unemployment remains structurally high, and young adults often experience delayed independence, temporary work, sectoral concentration and mismatch between qualifications and available jobs. The 2025 early-leaving rate was low at 3.0%, indicating that disengagement cannot be explained only by school dropout. Greece also records a comparatively high NEET rate among tertiary-educated young people, which points to graduate transition, job quality and matching problems.

Public Employment Service initiatives provide subsidised employment, training and entrepreneurship support. Youth Wiki reports a 2025–2026 programme for unemployed people aged 18–29 with a budget of approximately EUR 37 million and an objective of

creating around 2,100 new businesses. This creates an opportunity for YOUTH-IIT to complement financial support with practical digital product development, business validation and project-management skills. A grant can support business entry, but sustainability depends on customer evidence, cost control, operational discipline and the ability to communicate value.

Entrepreneurship education and support are fragmented across universities, incubators, EU-funded programmes, chambers, NGOs and DYPA actions. Strong start-up communities exist in major cities, but young people outside these networks may not know how to access mentors, finance or technical support. Rural and island contexts add transport and market-access constraints. The report therefore recommends examples that are relevant to small local services, tourism, agriculture, energy, logistics and community needs rather than only venture-capital technology start-ups.

### 5.2 Digital and IoT skills

The 2025 Digital Decade country report describes a severe gap in basic digital skills and a shortage of ICT specialists, despite strong 5G coverage, fibre investment and progress in SME digitalisation. This combination is important: infrastructure and public digital services can advance more quickly than the population's capacity to use technology confidently. Young people with higher education and urban access may be comfortable with digital platforms, while unemployed youth, migrants, older young adults and people in remote areas can face uneven support.

Greece has a significant technical and academic ecosystem, including universities, research centres, vocational providers, coding academies, innovation hubs and European Digital Innovation Hubs. However, introductory IoT learning is not consistently accessible to non-engineers. The YOUTH-IIT material should therefore use low-cost boards, browser-based simulations and highly guided tasks. The existing project manuals on Arduino, ESP32, Micro:bit, Raspberry Pi, sensors, Tinkercad and Wokwi provide a strong technical base, but the entry route should be simplified and connected to participant problems.

A Greek learning pathway could begin with energy consumption in a small tourism business, indoor temperature and humidity, irrigation, fire-risk awareness or air-quality monitoring. These examples are locally meaningful and can connect to sustainability and

entrepreneurship. Safety and reliability need explicit attention, especially for flame sensors, mains electricity, outdoor deployment and claims about environmental impact.

### 5.3 Needs of NEETs, migrants and young people with fewer opportunities

Greek NEETs are diverse. Some have completed tertiary education but lack relevant experience or networks; others have low qualifications, weak confidence or prolonged inactivity. Women may face care responsibilities, and people in islands or rural areas face geographic barriers. High living costs, insecure housing and transport can reduce the time and attention available for training. Recruitment through a single online campaign will miss the least connected groups.

Migrants and refugees may experience language barriers, documentation delays, uncertain employment pathways and reduced access to specialised support. UNHCR has reported barriers to employment, legal assistance, accommodation and social rights, as well as reductions in some employability and language services because of funding constraints. YOUTH-IIT cannot replace these services, but it can offer a predictable learning environment, clear referrals, language-sensitive facilitation and recognition of prior competence.

Accessibility should include mobile-first delivery, downloadable files, asynchronous completion windows and optional face-to-face support. The platform registration process should be tested with participants who have low digital confidence. A named contact person and short orientation session can prevent silent dropout. Certificates should state learning outcomes and practical tasks, not merely attendance.

### 5.4 Educational opportunities and gaps

| Available opportunity | Potential value | Observed gap for YOUTH-IIT target groups |
|---|---|---|
| DYPA youth employment and entrepreneurship programmes | Funding, activation, work experience and start-up entry | Training may not provide hands-on IoT product development or sustained mentoring. |
| Universities, research | High technical | Access may be concentrated in |

| Available opportunity | Potential value | Observed gap for YOUTH-IIT target groups |
|---|---|---|
| centres and incubators | expertise and innovation networks | cities and among already highly educated participants. |
| VET, lifelong learning and certification programmes | Structured skills routes and recognised outcomes | IoT content can be technical, fragmented or insufficiently connected to entrepreneurship. |
| EDIHs and SME digitalisation support | Advanced technology advice and business ecosystem links | Young informal entrepreneurs may not identify as eligible SMEs or know how to engage. |
| NGO and refugee-support initiatives | Trusted outreach and inclusion support | Capacity and funding may be uneven; technology curricula may be limited. |

### 5.5 Greece: provisional requirements

- Use a two-speed entry design: digital foundations and optional fast-track assessment for experienced learners.
- Prioritise practical examples in tourism, small business energy use, agriculture, environmental monitoring and local services.
- Offer Greek-language learner support and plain-English technical terms with a bilingual glossary.
- Combine asynchronous Open eClass content with scheduled workshops and office-hour support.
- Connect entrepreneurship content to DYPA and local ecosystem opportunities, while teaching validation and financial realism.

- Recruit through employment services, municipalities, NGOs and youth organisations, not only universities and ICT networks.

### 5.6 Greece: fieldwork hypotheses to test

Six hypotheses should be tested. First, digital confidence will vary more by educational and employment pathway than by age, with graduates reporting high general confidence but limited practical electronics. Second, participants will prefer short blended activities to long independent manuals. Third, environmental use cases tied to tourism, energy costs, agriculture and fire or air quality will motivate more than generic smart-home examples; the questionnaire should ask respondents to rank local problems rather than technology brands. Fourth, entrepreneurship needs will centre on customer identification, pricing, funding navigation and confidence in presenting an idea, and the study should separate those seeking self-employment from those treating entrepreneurship as an employment competence. Fifth, migrant and refugee participants will value bilingual support, flexible timing and recognition of prior experience. Sixth, geographic access will affect participation outside Athens and other large centres, and the study should record whether a loan-kit or local-hub model would materially improve it.

Suggested interview prompts: Which step of an online course causes most difficulty? What would make a technology course feel relevant to employment? Which local businesses could benefit from a simple sensor? What does a useful certificate need to show? Which participants are least likely to respond to an online recruitment campaign?

### 5.7 Greece: national evidence base

| Source | Contribution to this chapter | Quality note and limitation |
|---|---|---|
| Eurostat, datasets edat_lfse_20, edat_lfse_21 and edat_lfse_14 (2025 | NEET rate (13.6%), NEET by educational attainment (19.1% / 15.4% / 6.9%), early leaving (3.0%) | Official harmonised statistics. Age band is 15–29 or 18–24, not the project's 18–30; does not |

| Source | Contribution to this chapter | Quality note and limitation |
|---|---|---|
| reference year) | | explain individual causes. |
| European Commission, Greece Digital Decade country reporting (2025 and 2026 editions) | Basic digital skills (≈51.0%), annual decline since 2023, ICT specialists (2.5% of employment), 5G and fibre progress, SME digitalisation | Authoritative national synthesis. Indicator reference years vary within the report; some values lag by up to two years. |
| Eurostat, dataset isoc_sk_dskl (2025) | Youth digital skills, 16–24: 83.5% women, 75.3% men | Published by gender for Greece rather than as a single national value; the combined figure used here is derived. |
| European Commission / EACEA, Youth Wiki – Greece, Employment and Entrepreneurship chapters | DYPA employment and entrepreneurship measures, including the 2025–2026 programme for unemployed people aged 18–29 | Policy pages carry different update dates; budgets and eligibility change between calls and must be re-checked before referral. |
| UNHCR Greece factsheets and integration updates (2025) | Barriers facing refugees and migrants in employment, legal assistance, accommodation and language services | Focused on refugee and asylum-seeking populations; not representative of all migrant youth, and service availability changes with funding. |
| Education and Training | Upper-secondary | Comparative rather than |

| Source | Contribution to this chapter | Quality note and limitation |
|---|---|---|
| Monitor 2025, Greece country analysis | attainment among 20–24-year-olds (96.2%), participation in adult learning | granular; limited coverage of non-formal and youth-work provision. |

The Greek evidence base is strong on outcomes and weaker on the experience of specific subgroups. No available national source describes the digital confidence, device access or learning preferences of unemployed young adults, island and rural youth, or young refugees in a form that can be used directly for curriculum design. This is precisely the gap that the fieldwork in Sections 11 and 12 is intended to close, and it should be stated as a limitation rather than filled by inference from national averages.

## 6. National Analysis: Bulgaria

Bulgaria combines a distinctive youth-transition profile with a specific digital and entrepreneurship ecosystem. In 2025 the NEET rate for people aged 15–29 was 13.8%, the second-highest in the European Union, and the share of people aged 16–74 with at least basic overall digital skills was approximately 38.3%, the second-lowest in the Union. Among young people aged 16–24 the figure was 52.8% – one of only two national values in the EU below 60%, meaning that close to half of the project's target age group does not meet even the basic threshold. Two further findings should temper any narrative of steady progress. First, although the Bulgarian NEET rate fell substantially over the decade from 22.2% in 2015, it rose in the most recent year, from 12.7% in 2024 to 13.8% in 2025. Second, 76.7% of Bulgarian early leavers from education and training are not in employment, one of the highest non-employment shares in the Union. Bulgaria has strong connectivity infrastructure and emerging capacity in strategic technologies, but basic digital skills, adult learning, SME innovation and the inclusion of disadvantaged groups remain well below the desired level. The national analysis below separates headline performance from the barriers experienced by the YOUTH-IIT target groups and converts the findings into learning-service implications.

### 6.1 Situation of young people and youth entrepreneurship

Bulgaria's youth policy prioritises reducing unemployment and inactivity, particularly among young people with low education and those in peripheral regions. The National Youth Strategy 2021–2030, the Youth Guarantee, subsidised employment and training programmes provide a framework for activation. Nevertheless, the headline NEET rate remains above the EU average, and national averages conceal acute challenges among Roma youth, rural communities, early school leavers, young people with disabilities and long-term inactive youth.

Youth entrepreneurship is promoted through general innovation, competitiveness, social-economy and employment measures rather than a single comprehensive youth-entrepreneurship system. Youth Wiki notes that entrepreneurship is recognised as a key

competence in education, but there is no standalone strategy dedicated to developing entrepreneurship competence. EU programmes and Ministry of Innovation and Growth initiatives provide opportunities, while the National Network of Youth Centers supports non-formal learning and youth-worker development.

This policy landscape creates both opportunity and fragmentation. Young people may encounter separate training, employment and funding schemes without a coherent pathway from problem identification to prototype, business testing and market entry. YOUTH-IIT can add value by linking technical experimentation to a simple entrepreneurial process and by using youth centres and local NGOs as trusted access points.

## 6.2 Digital and IoT skills

Bulgaria's 2025 basic-digital-skills result was approximately 38.3%, far below the EU average and target. The Digital Decade country report identifies gaps particularly among disadvantaged groups, low adult-learning participation, below-average ICT training provision and a need to expand digital and green skills. At the same time, the country has strong high-speed connectivity, women perform comparatively well in some digital indicators, and Bulgaria is developing capabilities in semiconductors and quantum technologies.

The contrast between advanced national technology initiatives and low population-level skills means that YOUTH-IIT should not begin with abstract descriptions of IoT architecture. Participants should first gain confidence through visible cause-and-effect activities: read a temperature value, change a threshold, observe an LED or dashboard, and discuss the user decision that follows. Browser-based simulators can reduce hardware and installation barriers, but hands-on kits remain important for confidence and employability.

Environmental examples are relevant to air quality, energy efficiency, agriculture, water, indoor conditions and municipal services. Rural and small-town participants may see immediate value in soil-moisture, temperature, storage and resource-use applications. Local cases should be co-created with youth centres and community organisations so that the curriculum does not appear imported or urban-centric.

## 6.3 Needs of NEETs, migrants and young people with fewer opportunities

The most significant Bulgarian inclusion risks involve low educational attainment, rural isolation, Roma exclusion, disability, inactivity and weak participation in adult learning. Digital access may exist at household or community level while confidence, devices and support remain insufficient. A training model that assumes independent self-study may reproduce inequality. Facilitated onboarding, community-based sessions and repeated practice are likely to be more effective.

Bulgaria has also hosted people displaced from Ukraine. UNHCR evidence on refugee education shows that language proficiency, recent arrival, disability and parallel participation in host-country and Ukrainian systems affect access and persistence. Young adult refugees may face similar pressures in vocational learning and employment. Materials should allow bilingual scaffolding, flexible pacing and recognition that some learners are managing multiple systems and responsibilities.

Recruitment should work through the Employment Agency, youth centres, Roma mediators, municipalities, NGOs and refugee-support networks. Incentives should be transparent and modest; the strongest value proposition is a practical portfolio, accessible certificate, supportive team experience and connection to further learning or employment services.

## 6.4 Educational opportunities and gaps

| **Available opportunity** | **Potential value** | **Observed gap for YOUTH-IIT target groups** |
|---|---|---|
| Youth Guarantee and Employment Agency measures | Activation, training, subsidised employment and self-employment support | Difficult-to-reach inactive youth may remain outside registration and formal services. |
| National Network of Youth Centers | Trusted non-formal settings, youth-worker capacity and regional outreach | Technical equipment and trainer IoT competence may vary. |
| NAVET and vocational | Structured vocational | Fast-moving IoT and |

| Available opportunity | Potential value | Observed gap for YOUTH-IIT target groups |
|---|---|---|
| education | pathways and labour-market alignment | entrepreneurial applications may not be uniformly available. |
| Innovation and competitiveness programmes | Finance and innovation ecosystem | Young people with early ideas may find schemes complex or business-oriented rather than educational. |
| Digital education investment | Infrastructure and formal curriculum development | Basic skills and adult-learning participation remain weak, especially for disadvantaged groups. |

### 6.5 Bulgaria: provisional requirements

- Provide a low-threshold entry route with assisted onboarding and clear visual instructions.
- Use youth centres and community partners for blended delivery and device access.
- Include Bulgarian-language glossaries, captions and printable step-by-step sheets.
- Prioritise foundational digital skills, safe online behaviour, collaboration and troubleshooting before coding depth.
- Use agricultural, energy, air-quality and community-service examples with inexpensive sensors.
- Offer trainer preparation and a standard troubleshooting playbook to reduce variation between locations.

### 6.6 Bulgaria: fieldwork hypotheses to test

Bulgarian fieldwork should test whether assisted participation matters more than content quantity. First, a meaningful subgroup will have a smartphone but no

suitable computer, stable connection or independent study space; device questions must therefore distinguish ownership, shared access and the ability to install or run tools. Second, confidence with social platforms will coexist with weak structured digital habits. Third, community-based recruitment through youth centres, employment services and NGOs will produce a more diverse sample than general social-media promotion, and recruitment logs should compare channels. Fourth, practical interest will be highest where IoT connects to agriculture, energy, air quality and visible community issues; participants should describe local problems before being shown a device list. Fifth, trainers may report insufficient equipment, troubleshooting confidence and time for individual support, so the professional questionnaire must ask what organisations can contribute rather than whether they are interested. Sixth, visual and step-based resources may outperform long text, and the pilot should compare comprehension of a standard paragraph, an illustrated activity card and a short demonstration.

A final hypothesis concerns opportunity navigation: young people may know that national or EU programmes exist while lacking confidence about eligibility and next steps. The project should test whether a short national opportunity map increases perceived usefulness, without promising funding outcomes.

### 6.7 Bulgaria: national evidence base

| Source | Contribution to this chapter | Quality note and limitation |
|---|---|---|
| Eurostat, datasets edat_lfse_20 and edat_lfse_14 (2025 reference year) | NEET rate (13.8%), the 2024–2025 increase from 12.7%, non-employment among early leavers (76.7%) | Official harmonised statistics. Does not disaggregate Roma youth or other groups central to Bulgarian inclusion policy. |
| Eurostat, datasets isoc_sk_dskl_i21 and | Basic digital skills, 16–74 (38.3%) and 16–24 (52.8%) | The 16–74 figure is not specific to the target |

| Source | Contribution to this chapter | Quality note and limitation |
|---|---|---|
| isoc_sk_dskl (2025) | | group; the 16–24 figure is the more relevant denominator for YOUTH-IIT. |
| European Commission, Bulgaria Digital Decade country report (2025) | Connectivity strengths, skills gaps among disadvantaged groups, low adult-learning participation, below-average ICT training provision, semiconductor and quantum initiatives | Authoritative national synthesis; recommends action but does not quantify provision at regional level. |
| European Commission / EACEA, Youth Wiki – Bulgaria, Employment and Entrepreneurship chapters | National Youth Strategy 2021–2030, Youth Guarantee, Employment Agency measures, the National Network of Youth Centers, absence of a standalone entrepreneurship strategy | Describes policy intention rather than measured take-up; notes the absence of a dedicated entrepreneurship-competence strategy. |
| UNHCR regional evidence on refugee education and inclusion (2025) | Language proficiency, recent arrival, disability and parallel participation in host and Ukrainian systems | Refugee-specific; findings on school-age learners transfer only partially to young adults aged 18–30. |
| Education and Training Monitor 2025, Bulgaria country analysis | Adult-learning participation, early-leaving reduction of 5.2 pp over the decade, regional disparities | Comparative; national detail on non-formal youth provision is limited. |

The Bulgarian evidence base documents the scale of the skills deficit clearly but says very little about *why* participation in adult learning is low, or about what would make a technology course feel accessible to a young person in a peripheral region. Practitioner input through the professional questionnaire is therefore particularly important in Bulgaria, and the fieldwork plan should weight it accordingly.

## 7. National Analysis: Croatia

Croatia combines a distinctive youth-transition profile with a specific digital and entrepreneurship ecosystem. In 2025 the NEET rate for people aged 15–29 was 10.8%, marginally below the EU average, and the rate of early leaving from education and training was 2.1%, the lowest in the European Union. The share of people aged 16–74 with at least basic overall digital skills was approximately 63.4%, above the EU average, although the most recent comparable value published in Croatia's Digital Decade country report was for 2023 and Croatia is among ten Member States whose 2025 result is below its 2022 result. Two further findings qualify this apparently strong position considerably. Croatia records the largest education-related gap in basic digital skills in the entire Union, at 67 percentage points between the highly educated and those with no or low formal education. And 76.2% of Croatian early leavers are not in employment, among the highest non-employment shares in the EU. Croatia's averages are therefore good and its internal divisions are severe, which is a more demanding design problem than a uniformly low average. The national analysis below separates headline performance from the barriers experienced by the YOUTH-IIT target groups and converts the findings into learning-service implications.

### 7.1 Situation of young people and youth entrepreneurship

Croatia's 2025 NEET rate was slightly below the EU average, and its early-leaving rate of 2.1% was the lowest in the EU. These are important strengths, but they do not eliminate transition problems. Regional disparities, seasonal employment, outward migration, delayed independent living and skills mismatch affect young adults. Tourism provides employment and entrepreneurship opportunities while also creating seasonality and geographic concentration.

Youth Wiki cites Global Entrepreneurship Monitor data indicating strong entrepreneurial activity among people aged 18–34 in 2022, while also noting that Croatia lacks a current standalone youth-entrepreneurship strategy and that earlier entrepreneurship-learning strategies were not renewed. Entrepreneurship is included as a cross-curricular subject in

primary and secondary education. The policy system therefore recognises entrepreneurial competence, but non-formal public programmes specifically for youth entrepreneurship are limited.

The Croatian Employment Service provides employment subsidies, including green and digital measures, education vouchers and support through CISOK career centres. These mechanisms are highly relevant to YOUTH-IIT. The project can act as an entry-level, portfolio-based programme that helps young people identify whether they need further vocational training, a voucher-supported course, employment support or incubation.

### 7.2 Digital and IoT skills

Croatia's basic-digital-skills performance is above the EU average, and the Digital Decade report identifies strong progress in infrastructure and cybersecurity. However, SME digitalisation and adoption of cloud, AI and data analytics remain below EU expectations. Digital inclusion gaps affect rural residents and people with lower education. These findings suggest that the YOUTH-IIT curriculum can move relatively quickly from basic orientation to applied work, while retaining an accessible foundation for participants with fewer opportunities.

Croatia's environmental and economic context supports practical examples in tourism facilities, water management, energy use, agriculture, marine and coastal monitoring, indoor climate and municipal services. Learners should examine not only how to create a sensor prototype but how to maintain it, interpret false readings, communicate limitations and decide whether a business customer would pay for the service.

ESP32 is particularly relevant because built-in Wi-Fi supports connected prototypes at low cost. Arduino remains useful for basic electronics and abundant learning resources; Micro:bit is effective for visual, low-anxiety entry; and Raspberry Pi can support dashboards or edge processing for advanced learners. Tool choice should remain outcome-driven rather than brand-driven.

### 7.3 Needs of NEETs, migrants and young people with fewer opportunities

Croatia's lower headline NEET rate may make vulnerable groups less visible. Rural and island youth, people with disabilities, Roma youth, migrants and those outside

formal education networks can still face access barriers. Transport, seasonal work and inconsistent schedules may reduce participation in fixed-time programmes. A modular blended design allows learners to pause and return without losing the full pathway.

Croatia's employment and education voucher systems create formal opportunities, but participants need guidance to navigate them. YOUTH-IIT trainers should be prepared to signpost learners to CISOK, the Croatian Employment Service, local training providers and entrepreneurship support. The programme should also protect against overestimating readiness: high average digital skills do not imply knowledge of electronics, data ethics or structured digital teamwork.

Accessibility requirements include Croatian translation, clear technical terminology, captions and support for low-bandwidth or mobile access. The project should consider in-person kit sessions in areas where participants lack hardware. Peer teams can reduce anxiety, but task allocation should prevent experienced participants from doing all technical work.

### 7.4 Educational opportunities and gaps

| **Available opportunity** | **Potential value** | **Observed gap for YOUTH-IIT target groups** |
|---|---|---|
| Croatian Employment Service measures | Employment subsidies, green/digital support and activation | Participants may need introductory skills and navigation support before accessing formal measures. |
| Education vouchers | Funding for green, digital and general skills | Course selection may not provide integrated IoT, entrepreneurship and youth-work support. |
| CISOK centres | Career information, counselling and access to resources | IoT prototyping and enterprise testing are not necessarily core services. |

| Available opportunity | Potential value | Observed gap for YOUTH-IIT target groups |
|---|---|---|
| Cross-curricular entrepreneurship education | Early exposure to initiative, planning and value creation | Adult/young-adult non-formal pathways and practical start-up support are less systematic. |
| Strong digital infrastructure and public services | Good platform access and digital familiarity | Rural inclusion and advanced SME technology uptake remain uneven. |

### 7.5 Croatia: provisional requirements

- Use a diagnostic entry task and allow experienced participants to move rapidly into applied challenges.
- Build examples around tourism, water, coastal areas, energy, agriculture and local public services.
- Integrate career and training signposting, including CES vouchers and CISOK support.
- Use ESP32 for connected prototypes while retaining Micro:bit/Arduino as accessible entry options.
- Design flexible schedules around seasonal work and geographic constraints.
- Measure practical task completion and teamwork, not only self-reported satisfaction.

### 7.6 Croatia: fieldwork hypotheses to test

Croatian fieldwork should test whether higher average digital skills allow faster movement into application without excluding vulnerable learners – a question made sharper by Croatia's 67-point education gap. First, many respondents will be comfortable with online platforms and shared documents but unfamiliar with sensors, microcontrollers and data-quality concepts, so the diagnostic must separate professional digital collaboration from technical IoT experience. Second, tourism,

energy and water applications will attract strong interest, but open responses should allow logistics, agriculture, coastal protection and municipal ideas to emerge. Third, seasonal employment and geographic mobility will affect attendance, so participants should be asked about periods of the year, preferred session length and whether asynchronous catch-up is essential. Fourth, the availability of Employment Service vouchers and CISOK support increases the value of accurate referral information, and practitioners should identify which services are trusted and current locally. Fifth, entrepreneurial and technical confidence may diverge, producing distinct learner profiles that require rotating team roles. Sixth, the acceptability of ESP32 as the main connected platform must be judged on procurement, power, Wi-Fi, software and support, not on interest alone.

Focus groups should explore what employers and local partners regard as credible evidence of competence – a functioning prototype, a simulation link, a technical explanation, a documented team board, user feedback or a reflection on errors – because this shapes certification and portfolio requirements.

### 7.7 Croatia: national evidence base

| Source | Contribution to this chapter | Quality note and limitation |
|---|---|---|
| Eurostat, datasets edat_lfse_20 and edat_lfse_14 (2025 reference year) | NEET rate (10.8%), the lowest early-leaving rate in the EU (2.1%), non-employment among early leavers (76.2%) | Official harmonised statistics. The strong headline values mask regional, island and seasonal effects that the datasets do not isolate. |
| Eurostat, dataset isoc_sk_dskl_i21 (2025 reference year) | Basic digital skills (≈63.4%) and the EU's largest education- related gap, at 67 pp | The Croatian 2025 value is reported with a lag; no 16–24 value was published at the data cut-off. |

| Source | Contribution to this chapter | Quality note and limitation |
|---|---|---|
| European Commission, Croatia Digital Decade country report (2025) | FTTP and 5G deployment above EU average, cybersecurity progress, low SME uptake of cloud, AI and data analytics, recommendation to bridge the digital divide across age, education and rural–urban lines | Notes explicitly that 2023 is the most recent year available for basic skills; recommendations are directional rather than quantified. |
| European Commission / EACEA, Youth Wiki – Croatia, Employment and Entrepreneurship chapters | Global Entrepreneurship Monitor findings on 18–34 entrepreneurial activity, cross-curricular entrepreneurship education, absence of a current standalone youth-entrepreneurship strategy | GEM data cited are from 2022; the absence of a current strategy is a policy gap rather than a measured outcome. |
| Croatian Employment Service (HZZ) measures and CISOK career centres | Employment subsidies including green and digital measures, education vouchers, career guidance | Programme design and budgets change annually; must be re-checked before being used for referral. |
| Education and Training Monitor 2025, Croatia country analysis | Upper-secondary attainment among 20–24-year-olds (97.7%, the highest in the EU) | Comparative; limited detail on rural and island provision. |

Croatia illustrates the danger of designing from national averages. On every headline indicator it is the strongest partner country, yet it contains the widest educational division

in digital skills in the Union and a very high rate of non-employment among the minority who do leave education early. The fieldwork should therefore prioritise reaching participants outside the metropolitan and higher-education networks that would otherwise dominate a Croatian convenience sample.

## 8. National Analysis: Romania

Romania combines a distinctive youth-transition profile with a specific digital and entrepreneurship ecosystem, and presents the most acute needs of the four partner countries on every structural indicator. In 2025 the NEET rate for people aged 15–29 was 19.2%, the highest in the European Union; the rate of early leaving from education and training was 15.5%, also the highest in the Union and more than seven times the Croatian figure; and the share of people aged 16–74 with at least basic overall digital skills was 31.8%, the lowest in the Union. Among young people aged 16–24 the figure was 53.3%, one of only two national values below 60%, with young men (55.1%) ahead of young women (51.1%) – the second-largest reverse gender gap in the EU and a pattern that should shape recruitment. These outcomes coexist with high-quality fixed connectivity, a substantial pool of ICT graduates and major digital investment, but ICT specialists still account for only 2.9% of employment. Romania is therefore not a country with a uniform deficit; it is a country with an unusually wide internal distribution, and a single national average is especially misleading. The national analysis below separates headline performance from the barriers experienced by the YOUTH-IIT target groups and converts the findings into learning-service implications.

### 8.1 Situation of young people and youth entrepreneurship

Romania presents the most urgent youth-transition context among the four countries. The 2025 NEET rate was 19.2%, and early leaving from education and training was 15.5%, the highest in the EU. OECD analysis links high NEET levels to weak educational outcomes, regional disparities and limited labour-market integration. Rural areas, Roma communities, low-income households and young people with low educational attainment are particularly exposed.

Youth-employment measures include subsidies for employers recruiting graduates, NEETs and vulnerable young people, counselling, mobility bonuses and the national Youth Guarantee. Youth Wiki notes that many measures are part of general employment policy rather than a coherent youth-only system. EU funds remain central. This can create

significant opportunities but also programme complexity, uneven local implementation and dependence on project cycles.

Romania's Start-Up Nation 2024–2025 includes a pillar for young entrepreneurs under 30 and support for people aged 30–35 who are inactive, unemployed or disadvantaged. Previous programmes have supported student entrepreneurship and thousands of jobs. The policy opportunity is substantial, but young people need business literacy, realistic planning, digital product skills and trusted support to move from training or grant application to viable activity.

### 8.2 Digital and IoT skills

Romania's fixed connectivity is a major asset, but population-level basic digital skills remain extremely low. The Digital Decade country report also identifies weak SME and start-up innovation, low uptake of emerging technologies and difficulty retaining ICT talent. This produces a divided landscape: highly capable technical graduates coexist with many people who lack foundational skills. A single national average is therefore especially misleading.

YOUTH-IIT should use a clearly differentiated pathway. Entry-level learners may require basic device navigation, email, password safety, file upload, browser use and collaboration before using a simulator or board. More advanced learners should be offered extension challenges involving wireless sensors, dashboards, data logging and service design. Peer learning can bridge levels, but roles must rotate so that beginners complete observable technical tasks.

Romania has strong potential for IoT applications in agriculture, rural services, energy, logistics, environmental monitoring, manufacturing and smart communities. Low-cost hardware and open-source tools are appropriate, but procurement and local kit access must be planned. Where hardware cannot be provided to every participant, Wokwi or Tinkercad simulations can support initial practice, followed by shared in-person kits.

### 8.3 Needs of NEETs, migrants and young people with fewer opportunities

Romania's inclusion needs are structural and multidimensional. Rural distance, limited transport, poverty, low educational attainment, functional literacy, disability

and weak service access can combine. Some young people have internet access but share devices, rely on mobile data or lack a quiet learning space. Long text-heavy modules would create an avoidable barrier.

Roma youth and rural youth require trusted local intermediaries and culturally sensitive outreach. Recruitment through online advertising alone is inadequate. Public employment offices, NGOs, schools, local authorities, community centres and social services can support access. Facilitators should be prepared to provide practical help without stigmatising participants.

Romania is also an important host country for people displaced from Ukraine. Language proficiency and recent arrival affect participation in education and employment. The programme should provide Romanian-language support, plain English, visual instructions and flexibility for participants continuing Ukrainian online learning or managing family responsibilities. Documentation and legal questions should be referred to specialist organisations rather than handled informally by trainers.

### 8.4 Educational opportunities and gaps

| Available opportunity | Potential value | Observed gap for YOUTH-IIT target groups |
|---|---|---|
| Youth Guarantee and employment subsidies | Activation, work entry and support for NEET recruitment | Service reach and take-up can be uneven, especially in rural areas. |
| Start-Up Nation 2024–2025 | Significant route to training and start-up finance for young people | Applicants need practical business validation, digital competence and implementation support. |
| High-quality fixed connectivity | Supports online and blended learning | Connectivity does not equal skills, devices, confidence or accessible content. |
| Universities and ICT graduate pipeline | Strong advanced technical talent and | Talent retention and connection to disadvantaged |

| Available opportunity | Potential value | Observed gap for YOUTH-IIT target groups |
|---|---|---|
| | potential mentors | youth remain challenges. |
| EU-funded training and entrepreneurship projects | Large volume of opportunities | Fragmentation, project cycles and complex information can reduce accessibility. |

### 8.5 Romania: provisional requirements

- Make digital foundations a mandatory but diagnostic first layer, with fast-track options for advanced learners.
- Use short visual instructions, guided practice, assisted registration and low-bandwidth resources.
- Recruit through rural, Roma, employment, refugee and community networks and monitor sample diversity.
- Connect IoT projects to agriculture, energy, logistics, environment and local service challenges.
- Link entrepreneurship tasks to Start-Up Nation requirements without turning the course into a grant-writing exercise.
- Provide trainer scripts, escalation contacts and frequent support to reduce silent disengagement.

### 8.6 Romania: fieldwork hypotheses to test

Romanian fieldwork should test a strongly differentiated access model. First, the sample will contain both highly capable technical participants and young people who need help with basic online tasks; averages will conceal this polarisation, so results must be presented as distributions and learner profiles rather than means. Second, rural and low-income participants will face combinations of barriers – device sharing, mobile-data dependence, transport, literacy, limited local support – so the questionnaire must allow multiple barriers and recruitment must include

assisted completion. Third, entrepreneurship funding will attract interest, but participants may overestimate grants and underestimate market validation, cash flow and implementation. Fourth, agriculture, logistics, energy, manufacturing and local public services will be highly relevant, and the study should establish whether participants want to solve a workplace problem, build a business service or improve a community issue. Fifth, practitioners may report that short project-funded interventions provide insufficient follow-up, so the research should ask what support is needed after training. Sixth, Romanian and Ukrainian language support may matter for some participants, but the study must not assume that migrants need beginner content.

A seventh hypothesis concerns the reverse gender gap identified in §4.3, where young Romanian men outperform young women on basic digital skills. Recruitment should monitor the gender balance of the sample and ask whether outreach channels reach young women equally. Finally, retention is expected to depend on visible human support: the pilot should record support requests and response times as service indicators rather than informal exceptions.

### 8.7 Romania: national evidence base

| Source | Contribution to this chapter | Quality note and limitation |
|---|---|---|
| Eurostat, datasets edat_lfse_20 and edat_lfse_14 (2025 reference year) | The EU's highest NEET rate (19.2%) and highest early-leaving rate (15.5%) | Official harmonised statistics. Does not separately identify Roma youth, who are central to Romanian inclusion policy. |
| Eurostat, datasets isoc_sk_dskl_i21 and isoc_sk_dskl (2025) | The EU's lowest basic digital skills (31.8% for 16–74; 53.3% for 16–24, with 55.1% for men and | The gender pattern is the reverse of the EU norm and should be reflected in recruitment targets. |

| Source | Contribution to this chapter | Quality note and limitation |
|---|---|---|
| | 51.1% for women) | |
| European Commission, Romania Digital Decade country report (2025) | High-quality fixed connectivity, weak SME and start-up innovation, low uptake of emerging technologies, ICT talent retention difficulties | Authoritative; identifies problems more precisely than it quantifies regional variation. |
| OECD Reviews of Labour Market and Social Policies: Romania (2025) | Structural links between weak educational outcomes, regional disparities and labour-market integration | Detailed and Romania-specific, but published as a policy review rather than as a learner-level evidence source. |
| European Commission / EACEA, Youth Wiki – Romania, Employment and Entrepreneurship chapters | Youth Guarantee, employer subsidies for graduates, NEETs and vulnerable young people, mobility bonuses | Notes that many measures sit within general employment policy; implementation varies locally and depends on project cycles. |
| Start-Up Nation 2024–2025 programme documentation | Dedicated pillar for entrepreneurs under 30 and support for inactive, unemployed or disadvantaged people aged 30–35 | Eligibility, budget and timetable change between calls; must be re-checked before use in training or referral. |

The Romanian evidence base is the richest of the four in structural analysis and the poorest in describing what actually prevents an individual young person from completing an online course. The very wide internal distribution means that a Romanian sample drawn only from one channel will misrepresent the country in one direction or the other. The fieldwork plan

should therefore treat sample composition in Romania as a controlled variable rather than as an outcome of whoever responds first.

## 9. Cross-Country Synthesis

### 9.1 Comparative findings

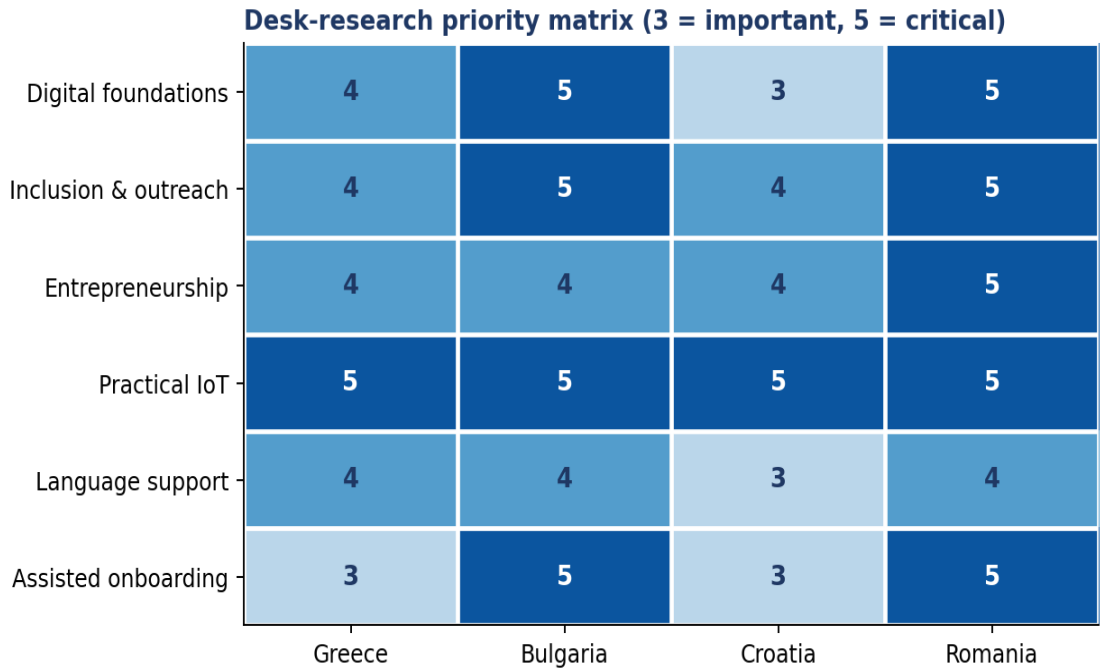
| Dimension | Greece | Bulgaria | Croatia | Romania |
|---|---|---|---|---|
| NEET pressure | High, despite major long-term improvement | High, with inactivity and peripheral-region concerns | Moderate relative to partners, but vulnerable groups remain | Very high; strongest activation need |
| Basic digital skills | Below EU average; ICT specialist shortage | Low; disadvantaged and rural gaps | Above EU average; advanced uptake gaps | Very low despite strong connectivity |
| Entrepreneurship opportunity | DYPA grants and active start-up ecosystem | General innovation and employment support; fragmented youth pathway | Strong entrepreneurial culture indicators and employment vouchers | Large EU-funded ecosystem and Start-Up Nation youth pillar |
| Key inclusion risks | Graduate mismatch, geography, migrants/refugees, care responsibilities | Roma, rural, low education, inactivity, disability | Rural/island access, seasonal work, vulnerable groups | Rural poverty, Roma exclusion, early leaving, weak foundational skills |

| Dimension | Greece | Bulgaria | Croatia | Romania |
|---|---|---|---|---|
| Recommended entry level | Foundation + optional advanced path | Strong foundation and assisted delivery | Diagnostic foundation; faster applied progression | Mandatory foundation with differentiated extension |
| High-value IoT contexts | Tourism, energy, agriculture, fire/air quality | Agriculture, air quality, energy, municipal needs | Tourism, water, coast, energy, agriculture | Agriculture, logistics, energy, manufacturing, communities |

The common need is not simply "more technology training". The four countries require a learning service that combines digital confidence, practical IoT understanding, entrepreneurship, sustainability and structured collaboration. The difference lies in entry conditions. Bulgaria and Romania require the strongest foundational and assisted-learning layer. Greece requires a foundation but also needs pathways for graduates and digitally capable youth who lack applied experience. Croatia can support faster progression for many learners while ensuring that rural and vulnerable participants are not excluded.

Across all countries, the programme should avoid using the term "digital native" as an instructional assumption. Young people can be highly active online while lacking file organisation, cybersecurity awareness, data interpretation, coding, troubleshooting or professional collaboration. A short diagnostic task is more reliable than age-based assumptions.

The most important inclusion principle is optionality without fragmentation. Participants should share a common learning journey and project identity, while accessing support, translation, pacing and extension tasks according to need. Separate "disadvantaged" courses can stigmatise learners; a universally accessible design with targeted support is preferable.




*Heat map of desk-research priorities for digital foundations, inclusion, entrepreneurship, practical IoT, language support and assisted onboarding across Greece, Bulgaria, Croatia and Romania, scored from three to five.*

**Figure 6. Analytical priority matrix based on desk research. Scores are an expert synthesis of documentary evidence, not field-survey results.**

## 9.2 Common barriers to engagement

- Unclear value: participants may not see how IoT relates to employment, entrepreneurship or daily problems.
- Technical anxiety: electronics, coding terminology and fear of breaking equipment can discourage beginners.
- Access: lack of a suitable device, unreliable internet, data cost, transport and limited kit availability.
- Time and instability: work shifts, care responsibilities, seasonal work, job search and migration processes.
- Language and literacy: complex English, dense manuals, unfamiliar technical vocabulary and low functional literacy.

- Weak support: unclear contact points, delayed trainer response and complex platform registration.
- Fragmented opportunity systems: learners may not know how training connects to employment services, finance or further education.
- Low trust: previous short-term projects or bureaucratic experiences can reduce willingness to participate.

### 9.3 Requirements traceability baseline

| Evidence-derived need | Service requirement | Verification indicator |
|---|---|---|
| Large cross-country gap in basic digital skills | Foundation module and diagnostic entry task | Registration/task completion; pre-course confidence and basic task success |
| High NEET rates and difficult-to-reach groups | Multi-channel recruitment and supported onboarding | Participant profile diversity; conversion from contact to enrolment |
| Advanced technology uptake below potential | Applied IoT prototypes linked to real user needs | Completed prototype or simulation and user-value explanation |
| Entrepreneurship support is fragmented | Opportunity mapping and referral component | Learners identify one relevant next-step service or programme |
| Language and access barriers | Multilingual, mobile-friendly and low-bandwidth formats | Accessibility checklist; participant barrier feedback |
| Need for green and practical relevance | Environmental and resource-efficiency use cases | Project briefs include measurable environmental or operational value |

| Evidence-derived need | Service requirement | Verification indicator |
|---|---|---|
| Need for teamwork and professional digital habits | Collaborative boards, shared files and team operating agreements | Visible task ownership, version control and peer feedback |

### 9.4 Priority learner profiles

National averages conceal very different starting points. For service design, YOUTH-IIT should work with evidence-based learner profiles rather than a single imagined "young entrepreneur". These are design lenses for testing whether onboarding, content, tools and support remain usable across common combinations of need. They are not demographic stereotypes and must not be used to label individuals.

| Profile | Defining characteristic | Service requirement |
|---|---|---|
| Digitally active beginner | Confident with smartphone and social media; limited file management, spreadsheets, sharing permissions or troubleshooting | A respectful digital foundation that teaches folders, naming, links, accounts, permissions and safe sharing through an immediate project task, with visible progress in session one. |
| Technically curious, entrepreneurship-inexperienced | Has used Arduino, coding, gaming or school robotics; little sense of users, costs, maintenance or how a prototype becomes a service | Every technical activity requires a defined user, problem, value statement, resource estimate and evidence of testing. Technical complexity alone earns no credit. |
| Employment- | NEET, early leaver or | Small early successes, explicit |

| Profile | Defining characteristic | Service requirement |
|---|---|---|
| focused, low confidence | graduate unable to enter the labour market; seeks proof of competence rather than business creation | instructions, mentoring, a portfolio artefact and signposting to employment or VET services at completion. |
| Migrant or multilingual | Technical level unknown; language confidence and familiarity with national services are the binding constraints | Plain language, visual demonstration, glossaries, captions, predictable navigation and a low-embarrassment route to asking questions. Translation alone is insufficient. |
| Rural or access-constrained | Transport, unstable connectivity, no equipment, schedules shaped by work or care | Low-bandwidth and downloadable resources, scheduled human support, shared hardware sessions, lending or team-based kit use, and documented contingency. |
| Requires an accessibility adjustment | Vision, hearing, mobility, neurodiversity, reading, concentration or anxiety – often not visible | The common service is accessible by default; individual adjustments are agreed confidentially. No separate “special” curriculum is created. |
| Advanced learner or peer mentor | Already codes, builds circuits or manages projects; risks | Extension challenges using ESP32 connectivity, dashboards, APIs, data |

| Profile | Defining characteristic | Service requirement |
|---|---|---|
| | disengagement or dominating a team | analysis or Raspberry Pi. Peer mentoring is explicit and recognised, never assumed. |

These profiles imply a layered service model. All participants receive the same orientation to project value, safety, collaboration and responsible IoT. Diagnostic activities then guide optional foundation, standard and extension routes. Teams may contain mixed levels, but task roles must rotate so that one experienced person does not perform all the meaningful work. Assessment should recognise problem understanding, teamwork, documentation, ethical judgement and reflection alongside technical function.

Fieldwork should test the prevalence of these profiles rather than asking respondents to choose a label. Evidence can be derived from combinations of device access, confidence items, labour status, prior experience, learning preferences and barriers, as collected in §12.3 to §12.7. Practitioners should be asked which profiles they encounter, where drop-out occurs and which support arrangements have worked.

## 10. Educational Service Design Recommendations

### 10.1 Recommended module architecture

The programme should use six core modules, consistent with the project's technical and collaborative-tool assets. Each module should contain: a plain-language introduction, one visual explanation, one practical demonstration, one guided task, one collaborative activity, one short quiz, one reflection or entrepreneurship prompt and one optional extension. Learning outcomes should be observable and written with action verbs.

| Module | Core content | Minimum practical output | Difficulty |
|---|---|---|---|
| 1. Digital confidence, safety and collaboration | Files, accounts, passwords, data, shared documents, online conduct, task ownership | Create a project folder, join a board, complete a privacy-aware form and agree team rules | Foundation |
| 2. Understanding IoT systems | Sensors, actuators, microcontrollers, connectivity, data, dashboards, user decisions | Explain a sensing–sending–understanding–responding chain for a local problem | Foundation |
| 3. Hardware and simulation basics | Arduino, Micro:bit, ESP32, GPIO, analog/digital input, breadboard/simulation, safe handling | Connect or simulate an LED and one sensor; read and explain output | Foundation–intermediate |
| 4. Environmental IoT applications | Temperature, humidity, light, soil moisture, air quality, energy, waste | Build or simulate a monitoring prototype and define | Intermediate |

| Module | Core content | Minimum practical output | Difficulty |
|---|---|---|---|
| | and responsible design | thresholds/actions | |
| 5. Entrepreneurship and service design | User needs, value proposition, business model, costs, risks, sustainability, data ethics | Produce a one-page concept and test it with at least three users or peers | Foundation–intermediate |
| 6. Team challenge and presentation | Project planning, Trello/Asana, documentation, testing, feedback, pitch and next steps | Team prototype/simulation, evidence pack, short presentation and improvement log | Intermediate with extension |

### 10.2 Level of difficulty and progression

The recommended starting level is beginner-friendly but not simplistic. Participants should be able to succeed without previous coding or electronics, while understanding that a prototype requires disciplined practice. Each module should use “essential”, “practice” and “extension” layers. The essential layer is required for all; the practice layer consolidates competence; the extension layer supports experienced learners without forcing the entire cohort to move faster.

A diagnostic activity should take place before or during Module 1. It should test practical tasks rather than ask only for self-rating: download and rename a file, upload it, interpret a simple chart, join a shared board and identify a safe password practice. For IoT, learners can classify sensors and actuators or modify a simple simulation. Results should guide support, not exclude participants.

Programming should be introduced through small modifications to working examples. Beginners should first change a value, pin, threshold or message and observe the result. Block-based tools or Micro:bit MakeCode can reduce anxiety, while Arduino-style code and

MicroPython can be offered progressively. The learning goal is computational thinking and control logic, not memorisation of syntax.

### 10.3 Preferred learning methods

| Method | Why it is recommended | Implementation rule |
|---|---|---|
| Short instructor demonstrations | Makes physical processes visible and reduces fear | Demonstrate one concept at a time; provide recording and transcript. |
| Guided hands-on tasks | Builds confidence and reveals actual support needs | Use checklists, expected outputs and troubleshooting prompts. |
| Browser-based simulation | Supports low-cost access and safe repetition | Do not rely on simulation alone; connect to physical kits when possible. |
| Peer teams | Develops collaboration and distributes problem-solving | Rotate roles so that every participant handles hardware, data and presentation. |
| Case studies and local challenges | Connects learning to employability and entrepreneurship | Use national examples and ask who benefits, who pays and what data are needed. |
| Quizzes and self-checks | Provides rapid feedback and identifies misconceptions | Keep low stakes; explain answers and allow retry. |
| Mentoring / office hours | Prevents silent disengagement and supports diverse levels | Publish response times and escalation routes. |
| Portfolio and presentation | Creates evidence of competence and motivation | Assess process, documentation and learning—not only technical polish. |

## 10.4 Accessibility requirements

Accessibility should be embedded in authoring and platform configuration. Text should use short paragraphs, descriptive headings, plain language and consistent terminology. Images require alt text; videos require captions and preferably transcripts; colour must not be the only way to communicate meaning. Documents should be downloadable and readable on mobile devices. Interactive tasks should work with keyboard navigation where possible.

Cognitive accessibility is equally important. Each task should state the purpose, required materials, estimated time, steps, expected result and what to do when the result differs. Examples should precede abstract theory. Glossaries should explain IoT, sensor, actuator, GPIO, data, dashboard, value proposition, prototype and privacy in everyday language.

Support should be visible. A learner who cannot log in or install software should know exactly whom to contact. Where possible, the programme should provide loan kits or shared sessions. Deadlines should allow reasonable flexibility, and participants should be able to complete equivalent simulation tasks if attendance or hardware access is temporarily impossible.

## 10.5 Language and format

English should remain the source-development language for consortium consistency, but learner-facing core materials should be available in Greek, Bulgarian, Croatian and Romanian. Translation should prioritise meaning and usability over literal equivalence. Technical terms may be retained in English when widely used, accompanied by a local explanation. The LMS should allow learners to identify language clearly and avoid mixing languages within one navigation route.

The recommended content unit is five to ten minutes of reading or viewing followed by action. Long manuals remain valuable as reference documents, but they should not be the only learning interface. Every major concept should have a concise web page, visual diagram, downloadable activity sheet and optional deeper reference. This approach aligns with the Open eClass modular structure and supports mobile and asynchronous learning.

### 10.6 Practical IoT tools of highest likely interest

| Tool | Recommended role | Rationale and limitation |
|---|---|---|
| Micro:bit | Lowest-threshold entry and visual experimentation | Buttons, LEDs, sensors and MakeCode are approachable; less direct for some business prototypes. |
| Arduino Uno / compatible board | Electronics and sensor fundamentals | Large ecosystem and simple examples; connectivity needs an additional module or board. |
| ESP32 | Connected environmental and business prototypes | Low cost with Wi-Fi/Bluetooth; pin configuration and power requirements require guidance. |
| Raspberry Pi | Optional advanced dashboards, gateways and data processing | Powerful and flexible; higher cost and setup complexity. |
| Tinkercad Circuits | Introductory simulation | Accessible and visual; component range and exact behaviour are limited. |
| Wokwi | Arduino/ESP32/MicroPython simulation and sharing | Strong for browser-based projects; still requires internet and guided templates. |
| Open eClass | Structured learning, assignments, questionnaires and tracking | Existing project platform; onboarding and mobile usability must be tested. |

| Tool | Recommended role | Rationale and limitation |
|---|---|---|
| Google Forms / Drive / Sites | Research, evidence, co-authoring and presentation | Familiar and flexible; privacy, permissions and account access must be managed. |
| Trello / Asana | Task visibility, team roles and progress | Useful only when integrated into a real project and kept simple. |

### 10.7 Assessment and certification

Assessment should combine completion, knowledge checks and performance tasks. A recommended model is 20% quizzes and reflection, 50% practical tasks, 20% team challenge and 10% documentation/presentation. The exact weighting can remain flexible, but the programme should avoid awarding competence solely for attendance.

A participant portfolio should contain screenshots or photographs, code or simulation links where appropriate, a brief explanation of the problem, sensor/data logic, team contribution, user feedback and one improvement made. Certification should list the completed modules and practical outcomes. Badges may support motivation, but they should not replace transparent criteria.

### 10.8 Trainer competence and facilitation model

Trainer readiness is a critical dependency. A technically strong trainer may use language that is inaccessible to beginners, while an experienced youth worker may need support with electronics and troubleshooting. The delivery model should therefore use complementary competence rather than expecting one person to master every domain. At minimum, each national team needs access to pedagogical facilitation, basic IoT technical support, inclusion/safeguarding knowledge and entrepreneurship guidance.

A standard trainer induction should cover project outcomes, target-group diversity, ITIL 4 guiding principles, Open eClass navigation, device safety, common hardware failures, privacy, accessibility, group roles, feedback and escalation. Trainers should complete every practical task as a learner before delivery and record any unclear instructions. A “known issues” sheet should identify board variants, driver or browser requirements, pin differences, power limitations and simulator constraints.

Facilitation should use a gradual release model: demonstrate; complete together; practise with support; complete independently; explain to a peer. Trainers should ask participants to predict outcomes before running code and to explain results afterward. When a circuit fails, the response should be structured: check power, ground, pin mapping, component direction, code selection, serial output and expected sensor range. This turns troubleshooting into a learning outcome instead of a source of embarrassment.

Inclusive facilitation requires active monitoring. Some participants may appear engaged while a more experienced teammate completes the work. Role rotation and individual checkpoints are necessary. Trainers should avoid public comparison of prior skill and should provide optional extension tasks quietly. Instructions should normalise error: prototypes rarely work perfectly at first, and the improvement log should reward diagnosis and reflection.

Trainer performance should be measured through learner support quality, clarity, timely feedback, safe practice and completion of evidence—not through the amount of content delivered. A short trainer reflection after each session should record what worked, recurring questions, access incidents, time variance and recommended changes. These reflections feed continual improvement and reduce repeated problems across countries.

## 10.9 Responsible IoT, cybersecurity and data ethics

Responsible IoT should be integrated across modules rather than isolated in a final ethics lecture. Every project collects or generates data, uses energy and creates potential failure modes. Learners should ask what is measured, why it is necessary, who can access it, how long it is retained and what happens if the reading is wrong. Personal data should be avoided in beginner projects unless there is a clear educational reason and appropriate safeguards.

Security concepts should be practical: change default passwords; avoid publishing credentials in code; use trusted networks; keep software updated; limit permissions; separate test data from personal accounts; understand that low-cost devices can become entry points into networks. The objective is not advanced cybersecurity certification, but habits that prevent predictable harm.

Environmental responsibility also requires critical thinking. An IoT solution may reduce energy or waste, but the device itself has material, energy and maintenance costs. Participants should compare connected and non-connected alternatives and explain why the chosen solution is proportionate. Projects should avoid exaggerated claims such as "saving the planet" based on a short sensor demonstration. They should instead state a measurable operational hypothesis: for example, monitoring room conditions may help identify unnecessary heating, or soil-moisture data may support more informed irrigation.

Data visualisation should represent uncertainty honestly. Learners should label units, time periods and sensor conditions. A chart without context can mislead. Modules should include examples of missing data, outliers and sensor drift. Participants should learn that deleting an inconvenient reading is not the same as resolving a data-quality problem.

Responsible design includes accessibility and non-discrimination. A service that requires an expensive smartphone, constant internet or advanced literacy may exclude the people it claims to help. Each team challenge should include an inclusion check and a security/privacy check before presentation.

## 10.10 National adaptation without curriculum fragmentation

The consortium should maintain one common competence framework while allowing national adaptation in examples, language, recruitment and support. Core learning outcomes, assessment criteria and questionnaire variables should remain comparable. National teams may select local case studies, relevant programmes, schedules and supplementary terminology. This balance protects European added value and prevents four unrelated courses.

Each national adaptation should document changes in a short localisation record: source version, translator/reviewer, examples replaced, legal or programme references added, accessibility adjustments and date. Changes to technical instructions require central review

because pin mappings, voltage or software steps cannot be modified casually. Changes to examples and language can be approved more flexibly.

National partners should develop an opportunity map covering public employment services, youth centres, digital innovation hubs, vocational providers, entrepreneurship support, refugee or disability organisations and relevant local networks. The map should be reviewed before each cohort because programmes change. It should be presented as signposting, not endorsement or guarantee.

A shared European team challenge can strengthen transnational learning. Teams from different countries may compare how the same problem—energy, water, air quality or waste—appears in different contexts. The technical core can remain common while the user, environment and business model differ. This demonstrates that transferability does not mean identical implementation.

## 10.11 Pilot validation and measurement

The needs analysis should lead to a minimum viable learning service that is tested before full deployment. The pilot is not a demonstration of finished materials; it is the controlled environment in which assumptions about level, pacing, accessibility, device choice, platform usability and perceived value are examined. A representative pilot includes learners with different starting levels and at least some of the barriers identified through national research. Where that is not feasible in one group, several small tests should target different service risks.

Pilot entry uses a brief diagnostic rather than a high-stakes test: complete a simple digital task, explain an everyday connected device, identify a local problem and rate confidence. Equivalent tasks are repeated at the end to observe practical change. Trainers record where instructions needed repeated clarification, where equipment or accounts failed, and which tasks produced genuine engagement.

Measurement combines four indicator types. *Output*: enrolment, attendance, module completion, practical tasks, prototypes, reflections. *Outcome*: change in digital confidence, ability to explain an IoT solution chain, use of collaboration routines, quality of problem–solution reasoning, ability to present a feasible next step. *Experience*: clarity, relevance, pacing, trainer support, platform usability, psychological safety. *Equity*: whether completion

and experience differ materially by country, access constraint, language support or starting confidence.

Illustrative service-level targets, to be adjusted after baseline evidence rather than treated as commitments in the approved application: at least 80% of enrolled participants access the first module; 70% complete the core learning path; 75% complete one practical IoT or simulation task; 70% report improved confidence in a targeted competence; 80% describe the content as relevant to an employment, enterprise or community objective; and every reported critical accessibility or safeguarding incident is acknowledged within two working days.

Technical acceptance criteria are required for practical activities. Success must not depend on a polished device: a team may demonstrate learning through a working circuit, a simulator, a correctly documented partial prototype or a reasoned design where equipment failure was beyond its control. Assessment must distinguish a learning error from a service failure such as unavailable hardware, broken links or unclear instructions.

At the end of each pilot cycle the work-package lead convenes a continual-improvement review that agrees improvement items with owners, deadlines and priority, and decides whether each change is local or affects the common curriculum. Changes with implications for safety, privacy, learning outcomes or cross-country comparability pass a central quality gate; minor language or example changes follow an expedited route. Closure of an improvement item requires proof that the revised element was retested, not merely that a file was changed. Recurring incidents trigger root-cause analysis: repeated login problems indicate weak onboarding, email filtering or unclear instructions rather than careless participants.

## 11. Field Research Implementation Package

### 11.1 Operational sequence

1. Approve the common English instruments and map every question to a report or curriculum decision.

2. Translate into Greek, Bulgarian, Croatian and Romanian; complete second-person review and cognitive testing.

3. Create country fieldwork plans with recruitment channels, sample diversity objectives, dates, owners and risks.

4. Pilot the questionnaire with 2–3 young people and one practitioner per country; log and approve changes.

5. Launch data collection, with weekly visibility of response counts, subgroup balance, missingness and incidents.

6. Conduct optional focus groups using the common guide and an anonymised note template.

7. Export, clean and code data using the shared variable dictionary; freeze a version for analysis.

8. Produce national tables and thematic summaries, then conduct a cross-country review workshop.

9. Update the recommendations and create a requirements traceability matrix linking findings to module decisions.

10. Archive the approved report, cleaned anonymised data, instruments, codebook, quality notes and acceptance record.

### 11.2 Roles and governance

| Role | Accountability |
|---|---|
| WP2 lead | Owns methodology, common instruments, codebook, consolidated analysis and quality gates. |

| Role | Accountability |
|---|---|
| National research lead | Owns translation, recruitment, local ethics compliance, data quality and national narrative. |
| Data analyst | Maintains clean dataset, reproducible tables, chart definitions and analysis log. |
| Inclusion reviewer | Checks sample diversity, accessibility, language and safeguarding implications. |
| Technical curriculum reviewer | Assesses whether recommended IoT tools and difficulty are feasible. |
| Quality approver / coordinator | Confirms traceability to the approved application and accepts the deliverable. |

### 11.3 Weekly fieldwork dashboard

| Indicator | Greece | Bulgaria | Croatia | Romania | Escalation threshold |
|---|---|---|---|---|---|
| Valid youth responses | Pending | Pending | Pending | Pending | Fewer than 15 by midpoint |
| Practitioner responses | Pending | Pending | Pending | Pending | Fewer than 3 by midpoint |
| NEET / inactive representation | Pending | Pending | Pending | Pending | No targeted outreach evidence |
| Rural / non-urban representation | Pending | Pending | Pending | Pending | Sample entirely metropolitan |
| Migrant/refugee or language-support insight | Pending | Pending | Pending | Pending | No evidence and no documented recruitment attempt |

| Indicator | Greece | Bulgaria | Croatia | Romania | Escalation threshold |
|---|---|---|---|---|---|
| Accessibility incidents | Pending | Pending | Pending | Pending | Any unresolved barrier >5 working days |
| Data-quality concerns | Pending | Pending | Pending | Pending | Duplicate or incomplete rate >15% |

### 11.4 Required primary-results outputs (delivered in Section 12)

- A participant profile table by country and labour status.
- Digital access and confidence chart, including device and connectivity barriers.
- IoT familiarity and tool-interest chart.
- Entrepreneurial confidence and priority-needs table.
- Preferred learning methods and scheduling chart.
- Accessibility and language requirements table.
- Practitioner comparison: barriers, trainer readiness, recruitment and support needs.
- Qualitative themes with anonymised, non-identifying quotations or paraphrases.
- A final requirements traceability matrix showing which recommendations are confirmed, modified or rejected by field evidence.

## 12. Presentation of Field Research Results

### 12.1 Purpose and rules of this section

This section is the reporting instrument for Part B of the deliverable. It contains every table and figure that the National Needs Analysis Report must present, with the categories, denominators, chart types and interpretation rules already fixed. National teams enter cleaned, anonymised data into the prepared structure; they do not redesign it. Fixing the presentation before collection is a deliberate methodological choice. When result formats are decided after the data are seen, category boundaries tend to migrate towards the more attractive finding, and cross-country comparability is lost.

All cells are shown as "[ ]" because no primary dataset accompanied this version of the report. An empty cell is a true statement about the current evidence position. It must not be filled with an estimate, a desk-research figure or a value transferred from another country.

Seven rules govern every table and figure in this section.

1. State the denominator. Every table reports *n* for the country and, where the question was optional or filtered, the number who answered that specific item.

2. Report counts alongside percentages whenever the base is fewer than 20 responses, and suppress or combine any cell with fewer than five observations that could identify a participant.

3. Mark multi-response questions clearly; their percentages may sum to more than 100%.

4. Treat "prefer not to say" as a valid response category, never as a negative answer and never as missing data.

5. Use identical scales, category order and colours across the four countries so that figures can be read side by side.

6. Do not describe a difference between countries as significant. The samples are small and non-probabilistic; describe patterns, and state where the pattern is consistent with the desk evidence in Sections 4–8 and where it contradicts it.

7. Label every result with an evidence status – Observed, Corroborated, Inferred or Provisional – when it is carried forward into Section 13.

### 12.2 Fieldwork account

The results chapter opens with a factual account of how the data were produced. This is what allows a reader, an evaluator or a National Agency to judge how much weight the findings can bear.

| **Fieldwork parameter** | **Greece** | **Bulgaria** | **Croatia** | **Romania** |
|---|---|---|---|---|
| Collection period (start – end) | [ ] | [ ] | [ ] | [ ] |
| Instrument version and language(s) | [ ] | [ ] | [ ] | [ ] |
| Recruitment channels used | [ ] | [ ] | [ ] | [ ] |
| Youth responses received | [ ] | [ ] | [ ] | [ ] |
| Youth responses excluded in cleaning (with reason) | [ ] | [ ] | [ ] | [ ] |
| **Valid youth responses (n)** | **[ ]** | **[ ]** | **[ ]** | **[ ]** |
| Valid practitioner responses (n) | [ ] | [ ] | [ ] | [ ] |
| Focus groups held / participants | [ ] | [ ] | [ ] | [ ] |
| Assisted completions (paper or facilitated) | [ ] | [ ] | [ ] | [ ] |
| Accessibility adjustments requested | [ ] | [ ] | [ ] | [ ] |
| Known under-represented groups | [ ] | [ ] | [ ] | [ ] |

**Figure 7 specification.** A simple flow diagram accompanies this table: contacts or invitations issued (where known) → responses received → records removed in cleaning →

records included in analysis. The purpose is transparency about attrition, not an appearance of statistical representativeness.

### 12.3 Participant profile

| Profile characteristic | Greece n=[ ] | Bulgaria n=[ ] | Croatia n=[ ] | Romania n=[ ] | Total n=[ ] |
|---|---|---|---|---|---|
| Age 18–20 | [ ] | [ ] | [ ] | [ ] | [ ] |
| Age 21–24 | [ ] | [ ] | [ ] | [ ] | [ ] |
| Age 25–27 | [ ] | [ ] | [ ] | [ ] | [ ] |
| Age 28–30 | [ ] | [ ] | [ ] | [ ] | [ ] |
| Employed or self-employed | [ ] | [ ] | [ ] | [ ] | [ ] |
| Student or trainee | [ ] | [ ] | [ ] | [ ] | [ ] |
| Unemployed and seeking work | [ ] | [ ] | [ ] | [ ] | [ ] |
| Not working and not seeking (inactive) | [ ] | [ ] | [ ] | [ ] | [ ] |
| **NEET (derived: unemployed + inactive, not in training)** | **[ ]** | **[ ]** | **[ ]** | **[ ]** | **[ ]** |
| Upper secondary or below | [ ] | [ ] | [ ] | [ ] | [ ] |
| Vocational / post-secondary | [ ] | [ ] | [ ] | [ ] | [ ] |
| Higher education | [ ] | [ ] | [ ] | [ ] | [ ] |
| Capital or large city | [ ] | [ ] | [ ] | [ ] | [ ] |
| Town or small urban area | [ ] | [ ] | [ ] | [ ] | [ ] |
| Rural, island or remote area | [ ] | [ ] | [ ] | [ ] | [ ] |

| Profile characteristic | Greece n=[ ] | Bulgaria n=[ ] | Croatia n=[ ] | Romania n=[ ] | Total n=[ ] |
|---|---|---|---|---|---|
| Prior entrepreneurship attempt (any) | [ ] | [ ] | [ ] | [ ] | [ ] |
| Reported at least one fewer-opportunity circumstance (optional item) | [ ] | [ ] | [ ] | [ ] | [ ] |

*Report as count and percentage of the national valid base. The fewer-opportunity row is derived from an optional, multi-select, non-exclusive question; state the number who selected "prefer not to say" in a note. Do not report individual sensitive categories where fewer than five respondents selected them.*

The narrative accompanying this table must state plainly which target groups were reached and which were not. A sample composed largely of students and employed graduates is not invalid, but it cannot be presented as evidence about NEETs, and every downstream recommendation derived from it inherits that limitation.

### 12.4 Digital access and practical confidence

| **Access indicator** (% of national base) | Greece n=[ ] | Bulgaria n=[ ] | Croatia n=[ ] | Romania n=[ ] | Total n=[ ] |
|---|---|---|---|---|---|
| Smartphone available for training | [ ] | [ ] | [ ] | [ ] | [ ] |
| Laptop or desktop available | [ ] | [ ] | [ ] | [ ] | [ ] |
| Shared or public computer only | [ ] | [ ] | [ ] | [ ] | [ ] |
| No reliable device | [ ] | [ ] | [ ] | [ ] | [ ] |
| Internet "very" or "mostly" reliable | [ ] | [ ] | [ ] | [ ] | [ ] |

| **Access indicator** (% of national base) | **Greece n=[ ]** | **Bulgaria n=[ ]** | **Croatia n=[ ]** | **Romania n=[ ]** | **Total n=[ ]** |
|---|---|---|---|---|---|
| Quiet place to study available | [ ] | [ ] | [ ] | [ ] | [ ] |
| Data cost reported as a barrier | [ ] | [ ] | [ ] | [ ] | [ ] |

| **Practical confidence (mean, 1–5, and % 4–5 | **Greece )** | **Bulgaria ** | **Croatia ** | **Romania** | **EU desk benchmark** |
|---|---|---|---|---|---|
| Download, rename and upload a file | [ ] | [ ] | [ ] | [ ] | – |
| Join a course and find assignments | [ ] | [ ] | [ ] | [ ] | – |
| Use shared documents and folders | [ ] | [ ] | [ ] | [ ] | – |
| Organise tasks on a board or to-do tool | [ ] | [ ] | [ ] | [ ] | – |
| Recognise unsafe links, passwords, privacy risks | [ ] | [ ] | [ ] | [ ] | – |
| **Composite DIG_CONF score** | **[ ]** | **[ ]** | **[ ]** | **[ ]** b s 7 | 16–24 asic kills: 4.6% EU |

**Figure 8 specification.** Grouped horizontal bar chart, one bar group per confidence item, four bars per group (one per country), showing the percentage rating themselves 4 or 5. Fixed 0–100% axis. This is the single most important figure for setting the entry level of Module 1, and it must be read alongside the age-specific national benchmarks in §4.3: if Bulgarian or Romanian respondents report high confidence while the national 16–24

benchmark is close to 50%, the gap is itself a finding about self-assessment, not evidence of readiness.

### 12.5 IoT awareness, experience and tool interest

| **IoT starting stage** (% of national base) | **Greece n=[ ]** | **Bulgaria n=[ ]** | **Croatia n=[ ]** | **Romania n=[ ]** | **Total n=[ ]** |
|---|---|---|---|---|---|
| Never heard of IoT | [ ] | [ ] | [ ] | [ ] | [ ] |
| Heard of it, unsure what it means | [ ] | [ ] | [ ] | [ ] | [ ] |
| Understands the basic idea | [ ] | [ ] | [ ] | [ ] | [ ] |
| Has used IoT devices | [ ] | [ ] | [ ] | [ ] | [ ] |
| Has built or programmed a connected project | [ ] | [ ] | [ ] | [ ] | [ ] |

| **Tool: seen, used or interested (%)** | **Greece** | **Bulgaria** | **Croatia** | **Romania** | **Interest rank** |
|---|---|---|---|---|---|
| Micro:bit | [ ] | [ ] | [ ] | [ ] | [ ] |
| Arduino | [ ] | [ ] | [ ] | [ ] | [ ] |
| ESP32 / ESP8266 | [ ] | [ ] | [ ] | [ ] | [ ] |
| Raspberry Pi | [ ] | [ ] | [ ] | [ ] | [ ] |
| Tinkercad or Wokwi simulation | [ ] | [ ] | [ ] | [ ] | [ ] |
| Environmental sensors | [ ] | [ ] | [ ] | [ ] | [ ] |
| Dashboards / data displays | [ ] | [ ] | [ ] | [ ] | [ ] |

| Application theme (top three, %) | Greece | Bulgaria | Croatia | Romania | Overall rank |
|---|---|---|---|---|---|
| Energy use and cost | [ ] | [ ] | [ ] | [ ] | [ ] |
| Temperature and humidity | [ ] | [ ] | [ ] | [ ] | [ ] |
| Air quality | [ ] | [ ] | [ ] | [ ] | [ ] |
| Agriculture and soil | [ ] | [ ] | [ ] | [ ] | [ ] |
| Water and irrigation | [ ] | [ ] | [ ] | [ ] | [ ] |
| Waste and recycling | [ ] | [ ] | [ ] | [ ] | [ ] |
| Safety and fire risk | [ ] | [ ] | [ ] | [ ] | [ ] |
| Transport and logistics | [ ] | [ ] | [ ] | [ ] | [ ] |
| Tourism and hospitality | [ ] | [ ] | [ ] | [ ] | [ ] |

| Concern about IoT learning (%) | Greece | Bulgaria | Croatia | Romania | Total |
|---|---|---|---|---|---|
| Coding | [ ] | [ ] | [ ] | [ ] | [ ] |
| Electronics | [ ] | [ ] | [ ] | [ ] | [ ] |
| Cost | [ ] | [ ] | [ ] | [ ] | [ ] |
| English terminology | [ ] | [ ] | [ ] | [ ] | [ ] |
| Fear of damaging equipment | [ ] | [ ] | [ ] | [ ] | [ ] |
| Privacy and security | [ ] | [ ] | [ ] | [ ] | [ ] |
| Mathematics | [ ] | [ ] | [ ] | [ ] | [ ] |
| No concerns | [ ] | [ ] | [ ] | [ ] | [ ] |

**Figure 9 specification.** Stacked horizontal bar, one bar per country, showing the five IoT starting stages as segments of 100%. This figure determines whether Modules 2 and 3 can share a common entry point.

**Figure 10 specification.** Clustered bar chart of tool interest by country. The accompanying text must state explicitly that interest is *not* a sufficient basis for tool selection: the decision in §13.6 also requires cost, procurement lead time, trainer competence, power and connectivity requirements, software installation constraints and accessibility, which are assessed separately in §12.8.

## 12.6 Entrepreneurial competence and learning preferences

| **Entrepreneurial confidence (mean 1–5, % rating 1–2)** | **Greece** ** | **Bulgaria** ** | **Croatia** ** | **Romania** | **Gap rank** |
|---|---|---|---|---|---|
| Identifying a problem worth solving | [ ] | [ ] | [ ] | [ ] | [ ] |
| Explaining the value of an idea | [ ] | [ ] | [ ] | [ ] | [ ] |
| Making a simple budget or price estimate | [ ] | [ ] | [ ] | [ ] | [ ] |
| Asking users for feedback | [ ] | [ ] | [ ] | [ ] | [ ] |
| Presenting to a group | [ ] | [ ] | [ ] | [ ] | [ ] |
| **Composite ENT_CONF** | **[ ]** | **[ ]** | **[ ]** | **[ ]** | – |

*The "% rating 1–2" column matters more than the mean. A module is justified by the size of the group that lacks confidence, not by the average of the whole sample. Rank the gaps to produce the Module 5 priority order.*

| **Preferred learning format (top three, %)** | **Greece** | **Bulgaria** | **Croatia** | **Romania** | **Overall rank** |
|---|---|---|---|---|---|
| Short videos | [ ] | [ ] | [ ] | [ ] | [ ] |
| Live face-to-face workshop | [ ] | [ ] | [ ] | [ ] | [ ] |
| Live online workshop | [ ] | [ ] | [ ] | [ ] | [ ] |
| Self-paced reading | [ ] | [ ] | [ ] | [ ] | [ ] |

| Preferred learning format (top three, %) | Greece | Bulgaria | Croatia | Romania | Overall rank |
|---|---|---|---|---|---|
| Step-by-step activity sheets | [ ] | [ ] | [ ] | [ ] | [ ] |
| Group challenge | [ ] | [ ] | [ ] | [ ] | [ ] |
| Mentoring | [ ] | [ ] | [ ] | [ ] | [ ] |
| Quizzes and games | [ ] | [ ] | [ ] | [ ] | [ ] |
| Case studies | [ ] | [ ] | [ ] | [ ] | [ ] |

| Scheduling preference (%) | Greece | Bulgaria | Croatia | Romania | Total |
|---|---|---|---|---|---|
| 30–45 minutes | [ ] | [ ] | [ ] | [ ] | [ ] |
| 60 minutes | [ ] | [ ] | [ ] | [ ] | [ ] |
| 90 minutes | [ ] | [ ] | [ ] | [ ] | [ ] |
| 2–3 hour workshop | [ ] | [ ] | [ ] | [ ] | [ ] |
| Weekday evening | [ ] | [ ] | [ ] | [ ] | [ ] |
| Weekend | [ ] | [ ] | [ ] | [ ] | [ ] |
| Asynchronous only | [ ] | [ ] | [ ] | [ ] | [ ] |

**Figure 11 specification.** Diverging or clustered bar chart of format preference by country, with a second panel disaggregating the pooled sample by labour status (in education / employed / NEET). The disaggregation is essential: if NEET respondents prefer different formats from students, an average preference would design the programme for the group that is easiest to recruit.

### 12.7 Accessibility, language and barriers

| Requirement (%, multi-select) | Greece | Bulgaria | Croatia | Romania | Total |
|---|---|---|---|---|---|
| Captions | [ ] | [ ] | [ ] | [ ] | [ ] |
| Transcript | [ ] | [ ] | [ ] | [ ] | [ ] |

| Requirement (%, multi-select) | Greece | Bulgaria | Croatia | Romania | Total |
|---|---|---|---|---|---|
| Audio explanation | [ ] | [ ] | [ ] | [ ] | [ ] |
| Large text or high contrast | [ ] | [ ] | [ ] | [ ] | [ ] |
| Keyboard navigation | [ ] | [ ] | [ ] | [ ] | [ ] |
| Printable version | [ ] | [ ] | [ ] | [ ] | [ ] |
| Simple-language summary | [ ] | [ ] | [ ] | [ ] | [ ] |
| Extra time | [ ] | [ ] | [ ] | [ ] | [ ] |
| Personal support | [ ] | [ ] | [ ] | [ ] | [ ] |
| **No adjustment needed** | **[ ]** | **[ ]** | **[ ]** | **[ ]** | **[ ]** |

| Language preference (%) | Greece | Bulgaria | Croatia | Romania | Total |
|---|---|---|---|---|---|
| National language only | [ ] | [ ] | [ ] | [ ] | [ ] |
| English only | [ ] | [ ] | [ ] | [ ] | [ ] |
| Both, in parallel | [ ] | [ ] | [ ] | [ ] | [ ] |
| Another language support needed | [ ] | [ ] | [ ] | [ ] | [ ] |

| Barrier to participation (%, multi-select) | Greece | Bulgaria | Croatia | Romania | Total |
|---|---|---|---|---|---|
| Time / work shifts | [ ] | [ ] | [ ] | [ ] | [ ] |
| Transport or distance | [ ] | [ ] | [ ] | [ ] | [ ] |
| Care responsibilities | [ ] | [ ] | [ ] | [ ] | [ ] |
| Cost | [ ] | [ ] | [ ] | [ ] | [ ] |
| Device or connectivity | [ ] | [ ] | [ ] | [ ] | [ ] |
| Language or reading difficulty | [ ] | [ ] | [ ] | [ ] | [ ] |

| Barrier to participation (%, multi-select) | Greece | Bulgaria | Croatia | Romania | Total |
|---|---|---|---|---|---|
| Anxiety or low confidence | [ ] | [ ] | [ ] | [ ] | [ ] |
| Disability or health | [ ] | [ ] | [ ] | [ ] | [ ] |
| Access to an IoT kit rated "essential" | [ ] | [ ] | [ ] | [ ] | [ ] |

**Reporting rule for this subsection.** Accessibility findings must be reported by *incidence*, not by average. A requirement selected by 8% of respondents is not a minority curiosity to be noted and set aside; if that 8% cannot complete the programme without it, the requirement is binding. The narrative should identify every adjustment selected by any respondent and state whether the design already provides it, will provide it, or cannot provide it and why.

### 12.8 Practitioner findings and feasibility assessment

| Practitioner assessment | Greece n=[ ] | Bulgaria n=[ ] | Croatia n=[ ] | Romania n=[ ] | Consolidated |
|---|---|---|---|---|---|
| Rating of young people's basic digital skills (mean 1–5) | [ ] | [ ] | [ ] | [ ] | [ ] |
| Most frequently cited digital skill gap | [ ] | [ ] | [ ] | [ ] | [ ] |
| Familiarity of their target group with IoT (mean 1–5) | [ ] | [ ] | [ ] | [ ] | [ ] |
| Weakest entrepreneurship skill | [ ] | [ ] | [ ] | [ ] | [ ] |
| Format producing best engagement | [ ] | [ ] | [ ] | [ ] | [ ] |

| **Practitioner assessment** | **Greece n=[ ]** | **Bulgaria n=[ ]** | **Croatia n=[ ]** | **Romania n=[ ]** | **Consolidated** |
|---|---|---|---|---|---|
| Main cause of dropout | [ ] | [ ] | [ ] | [ ] | [ ] |
| Organisation can provide: room / internet / devices / kits / outreach / mentoring | [ ] | [ ] | [ ] | [ ] | [ ] |
| Recommended entry level and session length | [ ] | [ ] | [ ] | [ ] | [ ] |
| Recommended primary IoT tool, with reason | [ ] | [ ] | [ ] | [ ] | [ ] |
| Trainer confidence to deliver IoT content (mean 1–5) | [ ] | [ ] | [ ] | [ ] | [ ] |

Practitioner responses must be reported alongside youth responses, never merged into a single denominator. Where the two groups disagree, the disagreement is itself the finding. Practitioners systematically observe things participants cannot self-report – silent dropout, the point in an onboarding sequence where people stop, the difference between claimed and demonstrated confidence – while participants are the only reliable source on motivation and perceived relevance.

The final row of this table feeds a decision that interest data alone cannot settle. Before any hardware is confirmed in §13.6, each national team completes the following feasibility check for every candidate tool: unit cost and procurement lead time; whether trainers can deliver and troubleshoot it without external help; power and connectivity requirements at the actual delivery venues; software installation constraints on available computers; safety considerations; and whether a first task can be completed successfully within one session

by a participant with no prior experience. A tool that fails the last of these should not be the entry tool regardless of how attractive it appears in Figure 10.

### 12.9 Qualitative themes

Qualitative results explain why the quantitative patterns occur, and they are the only part of the evidence base that can surface a problem nobody thought to ask about. Themes should be coded against the framework in Appendix D by at least two reviewers, with a calibration subset coded by both.

| **Theme (Appendix D code)** | **Countries where observed** | *Illustrative finding (paraphrased)** | **Curriculum or service implication** |
|---|---|---|---|
| Access | [ ] | [ ] | [ ] |
| Confidence | [ ] | [ ] | [ ] |
| Relevance | [ ] | [ ] | [ ] |
| Support | [ ] | [ ] | [ ] |
| Inclusion | [ ] | [ ] | [ ] |
| Pedagogy | [ ] | [ ] | [ ] |
| Technology | [ ] | [ ] | [ ] |
| Entrepreneurship | [ ] | [ ] | [ ] |

Quotations should be short, paraphrased where necessary to remove identifying detail, and labelled only by broad source – for example, “youth participant, Romania, no prior IoT experience”. They should not be selected because they are vivid or because they support the consortium’s existing plan. Contradictory and critical comments are the most valuable material in this section, because they identify service failures before participants experience them. Indicate the weight of a theme cautiously, using “several”, “a small number” or a count where coding is reliable, and report minority themes wherever they concern accessibility, safeguarding or trust.

## 12.10 Finding-to-requirement traceability matrix

This matrix is the formal handover from research to curriculum design and the artefact accepted at the WP2 quality gate. Every provisional decision in Section 13 appears here with its final status.

| Finding | Evidence source (§) | Evidence status | Learner profile affected | Requirement for the curriculum | Status: confirmed / modified / rejected |
|---|---|---|---|---|---|
| [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |
| [ ] | [ ] | [ ] | [ ] | [ ] | [ ] |

*Evidence status values:* ***Observed*** *– directly supported by cleaned primary data.* ***Corroborated*** *– the same pattern appears in primary and reliable desk evidence.* ***Inferred*** *– a reasonable design implication derived from the evidence but not explicitly requested by respondents.* ***Provisional*** *– a consortium judgement still requiring pilot validation.*

A recommendation that survives fieldwork unchanged should be recorded as confirmed rather than quietly left unmentioned; a recommendation that the evidence contradicts should be recorded as rejected rather than softened. Both outcomes are legitimate results of a needs analysis. Only the third possibility – a recommendation that proceeds without evidence and without acknowledgement – represents a failure of the process.

## 13. Conclusions and Recommendations

The desk research supports the core YOUTH-IIT rationale. Greece, Bulgaria, Croatia and Romania all need practical pathways that connect digital competence, IoT, entrepreneurship, collaboration and sustainability. The level and type of need differ substantially. Romania requires the strongest foundational and inclusion response; Bulgaria needs low-threshold, community-based delivery and should not be assumed to be on an improving trajectory; Greece needs applied and labour-market-facing provision more than remedial content, because its disengaged young people are disproportionately qualified; Croatia can progress faster into applied IoT for most learners while confronting the widest educational division in digital skills in the Union.

The six subsections below answer the specific design questions that the deliverable requires. Each states the recommendation, the evidence status and what would cause it to change.

### 13.1 Topics the educational modules should cover

**Recommendation.** Six modules, in the sequence set out in §10.1: (1) digital confidence, safety and collaboration; (2) understanding IoT systems as a sensing–connecting–processing–displaying–acting chain; (3) hardware and simulation basics; (4) environmental IoT applications; (5) entrepreneurship and service design; (6) a team challenge with presentation and an improvement log. Environmental use cases – energy, temperature and humidity, air quality, soil moisture, water and waste – supply the connecting narrative across modules rather than forming a separate "green" unit. Responsible IoT, data ethics and basic security are distributed across all six modules, not isolated in a closing lecture.

**Evidence status: Corroborated for Modules 1–2, Provisional for the weighting of Modules 4–5.** The need for a genuine digital foundation is established by the age-specific data: 52.8% of Bulgarians and 53.3% of Romanians aged 16–24 have at least basic digital skills, meaning close to half do not. The relative priority of environmental versus general business applications, and the ranking within Module 5, depend on §12.5 and §12.6.

**What would change it.** If fieldwork shows that respondents in Greece and Croatia consistently rate Module 1 content as already mastered *and* demonstrate it in the diagnostic, Module 1 becomes an optional prerequisite in those countries rather than a required unit. If application-theme rankings in §12.5 place transport, logistics or tourism above environmental monitoring in a given country, the national examples change while the module structure does not.

## 13.2 Level of difficulty

**Recommendation.** Beginner-accessible but not simplistic, delivered through three layers in every module – *essential* (required of all), *practice* (consolidation) and *extension* (for experienced learners) – with entry routed by a short practical diagnostic rather than by self-rating or by age. Programming is introduced by modifying working examples: change a value, a pin, a threshold or a message and observe the result. Block-based tools and MakeCode reduce entry anxiety; Arduino-style code and MicroPython are offered progressively. The diagnostic determines support and extension options; it never excludes a participant.

**Evidence status: Corroborated.** Three independent findings converge. First, the four countries occupy genuinely different positions: approximately half of the Bulgarian and Romanian target age group lacks basic skills, while roughly four in five young Greeks clear that threshold. Second, education, not age, is the dominant predictor – across the EU the gap between high and low educational attainment is 44 percentage points, and in Croatia it is 67. Third, Greece's inverted NEET pattern means that disengaged Greek participants are more likely to hold a degree than not. A single national difficulty setting would therefore be wrong in every partner country, and a single transnational setting would be wrong twice over.

**What would change it.** If the §12.3 profile shows that a national sample contains almost no low-confidence participants, the layering remains but the default route shifts. If the diagnostic proves too long or discouraging in pilot testing, it is shortened – not removed.

### 13.3 Preferred learning methods

**Recommendation.** Blended, modular and practice-led: short instructor demonstrations, guided hands-on tasks with checklists and expected outputs, browser-based simulation as a companion to physical kits, peer teams with rotating roles, local case studies, low-stakes quizzes with explained answers and retries, published office hours with stated response times, and a portfolio assessed on process and documentation rather than technical polish. The content unit is five to ten minutes of reading or viewing followed by an action. Long manuals remain valuable as reference but must never be the only interface.

**Evidence status: Inferred, pending §12.6.** The blended model follows from the access and barrier evidence rather than from stated preference, which has not yet been collected. Two structural facts make purely synchronous or purely self-paced delivery unsafe: seasonal and shift work in Croatia and Greece constrains fixed schedules, while the low adult-learning participation recorded in Bulgaria and Romania indicates that unsupported self-study is unlikely to be completed.

**What would change it.** The disaggregation in §12.6 is decisive. If NEET and employed respondents diverge sharply on format or session length, the programme offers parallel routes rather than a compromise that suits neither. If practitioners in §12.8 identify a dropout point that no format change addresses, the response is a support intervention, not a pedagogical one.

### 13.4 Accessibility needs

**Recommendation.** Accessibility is a design requirement, not an accommodation process. Standard provision: short paragraphs, descriptive headings, plain language and consistent terminology; alt text on images; captions and transcripts on video; no meaning conveyed by colour alone; downloadable, mobile-readable, low-bandwidth documents; keyboard-navigable interactive tasks. Cognitive accessibility carries equal weight: every task states purpose, materials, estimated time, steps, expected result and what to do when the result differs, and examples precede abstraction. Support must be visible – a named contact, a published response time and an

escalation route. Shared or loaned kits and equivalent simulation tasks ensure that hardware access is never a condition of completion. Individual adjustments are then agreed confidentially on top of an already-accessible common service; no separate "special" track is created.

**Evidence status: Corroborated.** Croatia's 67-point education gap, Romania's 31.8% adult basic-skills rate and the high non-employment shares among early leavers in Bulgaria (76.7%) and Croatia (76.2%) together establish that the participants most in need are the least likely to navigate an inaccessible platform unaided. The incidence data in §12.7 will size specific adjustments but cannot overturn the principle.

**What would change it.** Nothing in the fieldwork can reduce this baseline; §12.7 can only add to it. If a required adjustment cannot be delivered, that limitation is documented and communicated to participants in advance rather than discovered by them.

### 13.5 Language and format of the material

**Recommendation.** English remains the source-development language for consortium consistency; all learner-facing core material is available in Greek, Bulgarian, Croatian and Romanian. Translation prioritises meaning and usability over literal equivalence. Widely used technical terms may remain in English with a local explanation and a bilingual glossary covering IoT, sensor, actuator, GPIO, data, dashboard, value proposition, prototype and privacy. The LMS must label language clearly and must not mix languages within a single navigation route. Every major concept carries four formats: a concise page, a visual diagram, a downloadable activity sheet and an optional deeper reference.

**Evidence status: Corroborated by desk evidence; local preference pending §12.7.** "English terminology" is a distinct anticipated concern in the questionnaire precisely because technical vocabulary, rather than general English, is the usual obstacle. Migrant and refugee participants may need host-language scaffolding in addition to national-language material, and a learner may require language support while being technically advanced – the two must be assessed independently.

**What would change it.** If §12.7 shows substantial demand for parallel bilingual presentation rather than a national-language-only route, the platform structure changes accordingly. If a fifth language is needed for a specific cohort, that is a localisation decision recorded under §10.10, not a change to the core framework.

### 13.6 Practical IoT tools of greatest interest

**Recommendation.** Micro:bit and Arduino as the entry progression, ESP32 as the principal platform for connected prototypes, Raspberry Pi as an optional advanced extension only. Tinkercad and Wokwi simulation widen access and permit safe repetition but are companions to physical practice, not substitutes for it. Google Forms, Drive, Sites, Trello and Asana are taught as the operating environment of a real team project rather than as standalone software tutorials.

**Evidence status: Provisional.** This ordering is a consortium judgement based on cost, ecosystem maturity, connectivity and entry difficulty. It has not yet been tested against either participant interest (§12.5) or delivery feasibility (§12.8).

**What would change it.** The feasibility check in §12.8 takes precedence over the interest data in §12.5. If trainers in a country cannot troubleshoot ESP32 reliably, if procurement lead times are incompatible with the schedule, or if a beginner cannot complete a first successful task in one session, the entry tool changes even where interest is high. Conversely, strong interest in Raspberry Pi does not promote it out of the extension layer, because its cost and setup complexity would gate participation for the learners this project exists to reach.

### 13.7 Decision log

| ID | Decision | Evidence status | Validation required |
|---|---|---|---|
| D-01 | Six-module architecture with a digital foundation and a closing team challenge | Corroborated (structure) / Provisional (weighting) | §12.5, §12.6 confirm the weighting of Modules 4 and 5 |
| D- | Three-layer difficulty model | Corroborated | §12.3 profile; pilot |

| ID | Decision | Evidence status | Validation required |
|---|---|---|---|
| 02 | (essential / practice / extension) with a practical diagnostic entry | | test of diagnostic length |
| D-03 | Micro:bit and Arduino for entry, ESP32 for connected prototypes, Raspberry Pi as extension | Provisional | §12.5 interest and §12.8 feasibility; feasibility governs |
| D-04 | Core materials in four national languages plus an English source version | Corroborated | §12.7 confirms local language preference |
| D-05 | Blended, mobile-friendly, low-bandwidth Open eClass delivery with live support | Inferred | §12.6 format and scheduling data; LMS usability test |
| D-06 | Accessibility baseline applied to the common service, with confidential individual adjustments | Corroborated | §12.7 sizes specific adjustments; baseline is not contingent |
| D-07 | Recruit at least 30–40 young people and 5 practitioners per country | Methodological requirement | Fieldwork execution and the §11.3 dashboard |
| D-08 | Signposting and referral component connecting participants to national employment, VET and entrepreneurship services | Inferred | §12.8 identifies which services are current and trusted locally |
| D-09 | No primary results described until anonymised data and the | Mandatory integrity control | Section 12 completed with |

| ID | Decision | Evidence status | Validation required |
|---|---|---|---|
| | quality log are available | | real data |

From an ITIL 4 perspective, the next action is not to complete this report by adding unsupported narrative. It is to execute the fieldwork value stream with controlled instruments, transparent sampling, privacy safeguards, visible progress and a documented quality gate. Part A gives the consortium enough verified evidence to begin specifying the curriculum now. Part B determines whether that specification survives contact with the young people it is intended to serve.

## Appendix A. Youth Questionnaire (18–30 years)

**Suggested participant introduction**

YOUTH-IIT is an Erasmus+ project developing practical learning on digital collaboration, Internet of Things and entrepreneurship. This anonymous questionnaire takes approximately 8–12 minutes. Participation is voluntary. Please do not enter your name, exact address or other identifying information. Results will be analysed in aggregate to design accessible training in Greece, Bulgaria, Croatia and Romania.

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### A. Profile and current situation

1. Country of participation: Greece / Bulgaria / Croatia / Romania.

2. Age group: 18–20 / 21–24 / 25–27 / 28–30.

3. Current situation (select all): employed; self-employed; student; vocational trainee; unemployed and looking for work; not working and not looking; caring responsibilities; other; prefer not to say.

4. Highest level of education completed: lower secondary or below; upper secondary; vocational/post-secondary; higher education; other; prefer not to say.

5. Area of residence: capital/large city; medium or small town; rural area/village; island or remote area.

6. Have you previously tried to start a business, social initiative or freelance activity? Yes, currently active / Yes, but not active now / No, but interested / No and not currently interested.

7. Optional: Do any circumstances make education or employment harder for you? Low income; unemployment/inactivity; rural or remote location; migration/refugee situation; disability/health; care responsibilities;

language; discrimination; limited formal education; other; none; prefer not to say.

## B. Digital access and confidence

8. Which device could you normally use for training? Smartphone; laptop; desktop; tablet; shared/public computer; none reliably.

9. How reliable is your internet access? Very reliable / mostly reliable / sometimes unreliable / often unreliable / no regular access.

10. How confident are you in downloading, renaming and uploading a file? 1 not confident – 5 very confident.

11. How confident are you in joining an online course and finding assignments? 1–5.

12. How confident are you in using shared documents or folders? 1–5.

13. How confident are you in organising tasks using a board or to-do application? 1–5.

14. How confident are you in recognising suspicious links, unsafe passwords or privacy risks? 1–5.

15. Which barriers could affect online learning? Device; internet/data cost; platform difficulty; language; disability/accessibility; lack of quiet space; time; motivation; none; other.

## C. IoT awareness and practical interests

16. Before today, had you heard the term Internet of Things (IoT)? Never / heard it but unsure / understand basic idea / have used IoT devices / have built or programmed a project.

17. Which items have you used or seen? Smart home device; wearable; environmental sensor; Arduino; ESP32/ESP8266; Micro:bit; Raspberry Pi; Tinkercad/Wokwi; dashboard; none.

18. How interested are you in learning to connect and read a sensor? 1–5.

19. How interested are you in simple coding or block programming? 1–5.

20. How interested are you in building a Wi-Fi-connected prototype? 1–5.

21. Which practical themes interest you most (choose up to three)? Energy use; temperature/humidity; air quality; agriculture/soil; water; waste/recycling; safety; transport/logistics; tourism; health/well-being; smart home; other.

22. Which tool would you most like to try? Micro:bit; Arduino; ESP32; Raspberry Pi; simulator first; not sure.

23. What worries you about IoT learning? Coding; electronics; cost; English terminology; fear of damaging equipment; privacy/security; mathematics; nothing; other.

## D. Entrepreneurship and collaboration

24. How confident are you in identifying a problem that customers or communities need solved? 1–5.

25. How confident are you in explaining the value of an idea? 1–5.

26. How confident are you in making a simple budget or price estimate? 1–5.

27. How confident are you in asking users for feedback? 1–5.

28. How confident are you in presenting an idea to a group? 1–5.

29. Which business topics are most useful? Customer needs; business model; budgeting; marketing; funding; legal basics; data/privacy; teamwork; project planning; sustainability; pitching.

30. In team projects, which role do you prefer? Ideas/problem research; practical building; coding; organisation; communication/design; presentation; not sure.

31. Which tools have you used for organised teamwork? Google Drive/Docs; Google Forms; Trello; Asana; Teams/Slack; Google Sites; none; other.

## E. Learning preferences and accessibility

32. Preferred learning format (choose up to three): short videos; live face-to-face workshop; live online workshop; self-paced reading; step-by-step activity sheets; group challenge; mentoring; quizzes/games; case studies.

33. Preferred session length: 30–45 minutes / 60 minutes / 90 minutes / 2–3 hour workshop / mixed.

34. Preferred schedule: weekday morning / afternoon / evening / weekend / asynchronous only / varies.

35. Which language would help you learn most effectively? National language; English; both; another language support needed.

36. Which accessibility formats would help? Captions; transcript; audio explanation; large text; high contrast; keyboard navigation; printable version; simple-language summary; extra time; personal support; none; other.

37. Would access to a shared or loaned IoT kit affect participation? Essential / helpful / not necessary / not sure.

38. What would motivate you to complete the programme? Certificate; portfolio/project; employment relevance; business idea; meeting peers; mentor support; competition/prize; community impact; other.

39. What is the main reason you might stop participating? Open text.

40. Describe one problem in your community, workplace or daily life that technology might help solve. Open text.

41. Any other suggestion for YOUTH-IIT training? Optional open text.

## Appendix B. Youth-Professional Questionnaire

**Target respondents**

Youth workers, trainers, employment advisers, NGO staff, career counsellors, educators, mentors and other professionals working directly with young people.

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1. Country and type of organisation.

2. Professional role and approximate years of experience with young people.

3. Which groups do you work with? Students; unemployed; NEETs; migrants/refugees; Roma youth; rural youth; young people with disabilities; young entrepreneurs; other.

4. What are the three most important barriers to employment or entrepreneurship for young people in your context?

5. How would you rate young people's average basic digital skills? 1 very low – 5 very high.

6. Which digital skill gaps are most common? File management; online safety; collaboration; data; content creation; troubleshooting; coding; platform use; other.

7. How familiar are the young people you support with IoT, sensors or microcontrollers? 1–5.

8. Which IoT applications would be most relevant locally?

9. Which entrepreneurship skills are weakest?

10. What learning formats produce the best engagement with your target groups?

11. What causes dropout from training?

12. Which language, literacy or accessibility barriers must be addressed?

13. Can your organisation support devices, rooms, internet, outreach, mentoring or kits? Please specify.

14. Which national programmes or services should YOUTH-IIT connect with?

15. Which tools should be prioritised: Micro:bit, Arduino, ESP32, Raspberry Pi, simulators, collaborative tools? Why?

16. What is the appropriate entry level and session length?

17. What evidence would convince employers or partners that participants gained useful competence?

18. What safeguarding, privacy or ethical risks should the programme manage?

19. Would you participate in a pilot, mentoring session or curriculum review? Yes/No/Maybe.

20. Final recommendations or warnings for the curriculum.

## Appendix C. Focus-Group Guide (6–8 participants, 60–90 minutes)

| Stage | Time | Facilitator prompts | Evidence to capture |
|---|---|---|---|
| Welcome and consent | 10 min | Explain purpose, confidentiality limits, voluntary participation and recording/note method. | Consent, participant codes and group profile. |
| Youth situation | 10 min | What makes education, employment or entrepreneurship easier or harder for young people locally? | Barriers, services, differences between groups. |
| Digital and IoT readiness | 15 min | What digital tasks feel easy? What feels difficult? What do people understand by IoT? | Confidence, misconceptions, access, examples. |
| Learning preferences | 15 min | Show two sample formats or tasks. Which is clearer? What support would be needed? | Format, pacing, language, accessibility. |
| Practical tool interest | 15 min | Discuss Micro:bit, Arduino, ESP32, Raspberry Pi and simulation examples. Which problems would they like to solve? | Tool interest, project ideas, concerns. |
| Entrepreneurship and next steps | 10 min | How should a technical idea connect to customers, jobs, funding or community value? | Business support needs and referral opportunities. |
| Prioritisation and close | 10 min | Ask the group to select the five most important programme requirements. | Ranked priorities and dissenting views. |

**Facilitation rule**

Do not ask participants to disclose traumatic migration, health, financial or discrimination experiences. Accept general descriptions, allow non-response, and signpost specialist support when necessary.

## Appendix D. Coding and Analysis Framework

| Variable / code | Definition | Example reporting |
|---|---|---|
| COUNTRY | EL, BG, HR, RO | Response count and percentage by country |
| STATUS_NEET | Not employed and not in education/training at survey time | NEET representation in project sample |
| DIG_ACCESS | Composite of reliable device, internet and study access | Low / medium / high access |
| DIG_CONF | Mean of practical digital confidence items | Country and subgroup mean; distribution |
| IOT_STAGE | Never heard / aware / user / practical builder | Starting-level distribution |
| ENT_CONF | Mean of problem, value, budget, feedback and pitch confidence | Priority entrepreneurship gaps |
| FORMAT_PREF | Multi-response learning-format choices | Top formats by country and subgroup |
| ACCESS_NEED | Language, disability, bandwidth, time, device or support need | Accommodation requirements |
| TOOL_PREF | Micro:bit / Arduino / ESP32 / Raspberry Pi / simulation / unsure | Hardware and simulation priority |
| BARRIER_THEME | Qualitative thematic code | Time, anxiety, cost, language, trust, care, transport, etc. |
| PROJECT_IDEA | Categorised environmental/business use case | Energy, air, agriculture, water, waste, logistics, tourism, other |

## Suggested qualitative codebook

| Theme | Definition | Possible subcodes |
|---|---|---|
| Access | Material or technical ability to participate | Device; connectivity; transport; kit; study space |
| Confidence | Belief in ability and fear of failure | Coding anxiety; electronics anxiety; presentation; prior negative experience |
| Relevance | Perceived connection to goals and local problems | Employment; business; community; sustainability; certification |
| Support | Human or organisational assistance | Trainer response; peer help; mentoring; referral; onboarding |
| Inclusion | Barrier related to social position or accessibility | Language; disability; discrimination; care; migration; rurality |
| Pedagogy | Preferences for how learning happens | Practice; video; live; self-paced; repetition; assessment |
| Technology | Tool or platform opportunities and limitations | Board preference; simulation; LMS; security; maintenance |
| Entrepreneurship | Capability to turn an idea into value | Customer; finance; marketing; business model; risk; regulation |

## Appendix E. Source Matrix and Bibliography

### E.1 Core source matrix

| Source | Use in report | Quality / limitation |
|---|---|---|
| YOUTH-IIT approved application, KA220-YOU-983A7315 | Project objectives, target groups, WP2 outputs, tools and programme logic | Primary project source; some statements are proposal assumptions to be tested. |
| YOUTH-IIT ITIL 4 Institutional Manual | Governance, value streams, quality gates, inclusion and continual improvement | Project-specific operational source. |
| Eurostat NEET dataset edat_lfse_20 | Comparable 2025 NEET rates for EU and four countries | Official comparable statistics; does not explain individual causes. |
| Eurostat digital skills datasets eq_dskl07 / isoc_sk_dskl_i21 | 2025 basic digital skills comparison | Population aged 16–74; not specific to the 18–30 target group. |
| European Commission Digital Decade Country Reports 2025 | National digital infrastructure, skills, SME adoption and recommendations | Authoritative national synthesis; data years vary by indicator. |
| European Commission Youth Wiki | National employment, entrepreneurship, training and inclusion policies | Useful policy mapping; pages have different update dates and national detail. |
| Eurofound youth reports | Cross-European NEET, digitalisation, labour-market and inclusion analysis | Strong comparative evidence; not a substitute for local |

| Source | Use in report | Quality / limitation |
|---|---|---|
| | | fieldwork. |
| OECD Romania labour-market review 2025 | Education, NEET and labour-market structural context | Detailed country analysis; Romania-specific. |
| UNHCR refugee education and national information | Migration, language, education and inclusion barriers | Focused on refugee populations; experiences vary by country and age. |
| YOUTH-IIT IoT, LMS and collaborative-tool manuals | Existing technical and learning-platform assets | Content must be validated for target-group level, accessibility and currency. |

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## E.3 Verification note

All European and national comparative indicators cited in Sections 4 to 9 were re-verified against the primary statistical releases listed above during preparation of Version 2.0. Where Version 1.0 contained a figure that could not be verified, or that had been superseded, the figure was corrected and the correction is recorded in the change table at the front of this report. Four categories of correction were applied: (a) the EU basic-digital-skills value and its national counterparts were aligned to the 2025 reference year; (b) age-specific (16–24) digital-skills data were added, since the 16–74 population is not the project's target group; (c) trend statements were corrected where the most recent movement was adverse, specifically for the Bulgarian NEET rate and for basic digital skills in Greece and Croatia; and (d) early-leaving and ICT- specialist indicators were introduced to distinguish transition problems from attainment problems.

Statistical data cut-off for external desk research: August 2026. National programme details – budgets, eligibility, call timetables and service availability – change frequently and must be re-checked immediately before publication or before being used to refer a participant to a service.

**End of Part A** | | Part A of this deliverable is complete and may be used to begin | curriculum specification. To issue the final National Needs Analysis | Report, complete Section 12 with the cleaned anonymised dataset, national response counts, figures, qualitative themes and the | finding-to-requirement traceability matrix, then update the evidence | status of each recommendation in Section 13. The final report must | continue to distinguish desk evidence, field evidence and consortium | judgement. |

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