



CAREERS 4.0

Methodology corresponding to the established outcomes of WP's

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1. Context

This methodology outlines the comprehensive framework for implementation, monitoring, quality assurance and evaluation adopted within the CAREERS 4.0 project. It is fully aligned with Erasmus+ quality standards and European principles of transparency, accountability and continuous improvement, and is structured according to the four Work Packages (WP1–WP4).

The proposed methodological approach integrates rigorous project management principles, evidence-based scientific research methods, advanced digital innovation processes and structured capacity-building strategies. Through this integrated framework, the methodology ensures systematic development, validation and delivery of project high quality results, relevant to labor market and educational needs, and sustainable beyond the project's lifecycle.

2. Description of WP's

WP1 – Project Management, Quality Assurance and Evaluation (QA&E)

According to the project application, the overall objective of WP1 is to ensure the effective, timely and high-quality implementation of all project activities and deliverables. A comprehensive quality management framework is established at the beginning of the project through the appointment of a Quality Assurance Team (Q.A. Team), coordinated by CMBRAE, which acts as an impartial internal quality auditor.

The Q.A. Team is responsible for defining management procedures, roles and responsibilities, monitoring progress, assessing the quality of results and proposing corrective actions where necessary. Quality assurance measures are formalized in the "Guidelines for Quality Assurance", which specify, for each partner and each task, the responsible persons, timelines and expected results.

Monitoring follows the PDCA (Plan–Do–Check–Act) cycle. During the PLAN phase, activities are defined according to the approved project proposal and quality guidelines. In the DO phase, partners implement activities as planned. The CHECK phase involves systematic monitoring and verification of activities and work packages by the Q.A. Team, comparing actual progress with objectives, indicators and expected outcomes. In the ACT phase, improvement measures are proposed and implemented, leading to the elaboration of activity improvement plans (OUT).

Evaluation is based on multiple sources of evidence, including quantitative and qualitative data collected from partners during meetings, feedback questionnaires completed by staff, beneficiaries and stakeholders after each activity, progress reports produced by the Q.A. Team, and reports addressing identified problems,

risks, conflicts and solutions. Quality monitoring is conducted continuously, complemented by quarterly “Quality Check Points” consisting of bilateral online meetings between the Q.A. Team and each partner, and by six-monthly internal self-evaluation reports prepared by partners.

The QA&E process is coordinated by CMBRAE. All partners actively contribute to quality processes, bringing complementary expertise in quality management, evaluation, implementation and exploitation.

WP2 – Career Competencies 4.0 Framework and adequate psychometric skill assessment questionnaires

WP2 focuses on the scientific development and validation of the Career Competencies 4.0 Framework and the associated skills assessment battery. This work package is grounded in a rigorous, evidence-based methodological approach aimed at ensuring both conceptual soundness and psychometric robustness, in line with international standards in competence modelling and educational assessment.

WP2/A.2.1 involves a systematic and comparative review of existing European and international competence frameworks relevant to Industry 4.0, career development and employability. This review enables the identification of transversal and sector-relevant competences required in rapidly evolving labour market contexts. Competencies are conceptualized as an integrated and dynamic combination of knowledge, skills and attitudes, extending beyond purely cognitive dimensions to include key non-cognitive competences such as adaptability, resilience, ethical awareness, collaboration, self-regulation and problem-solving. The resulting framework provides a coherent reference model for both assessment and guidance purposes.

WP2/A.2.2 addresses the development of the theoretical and psychometric foundations of the Careers 4.0 skills assessment battery. The methodology encompasses the definition of clear theoretical construct, the development of appropriate measurement scales and scoring procedures, and the design of scenario-based assessment items that require respondents to make decisions in realistic, work- and career-related situations. This approach enables the assessment of applied competences, behavioral tendencies and decision-making patterns rather than declarative knowledge alone. All items undergo expert review by selected specialists in the partner countries, followed by systematic cross-cultural and linguistic adaptation using the back-to-back translation method, and pilot testing with representative target groups to ensure clarity, relevance and cultural appropriateness.

WP2/A.2.3 concerns the standardization and finalization of the Careers 4.0 skills assessment battery. The preliminary version of the instrument is administered to a sample of 300 young people (50 per partner), ensuring adequate representation

across contexts. Statistical analyses are conducted to examine key psychometric properties, including reliability, internal consistency and construct validity, and to establish normative data and standardized scoring procedures. Raw scores are transformed into standard scores to allow meaningful interpretation and comparison. The process culminates in the production of the final validated version of the assessment tools, accompanied by a comprehensive technical manual providing methodological guidance and practical instructions for trainers, career guidance practitioners and other end users.

To measure the achievement of the objectives of WP2 and the result quality, the partnership will use as reference guide the following indicators:

Quantitative indicators:

- Production of 1 Career Competencies 4.0 Framework
- Production of 1 Careers 4.0 skill assessment battery
- Engagement of 15 employers, and relevant VET stakeholders, in the partner countries in the evaluation and development of the Career Competencies 4.0 Framework
- Engagement of 15 experts in the partner countries in the evaluation and development of the Careers 4.0 skill assessment questionnaires
- Engagement of 300 (50 per partner) young people (16-29 y.o) in the data collection (administration of the Careers 4.0 skill assessment battery)

Qualitative indicators. The quality of the WP2 will be evaluated by:

- The evaluation rate by the experts on the overall content of the tool: at least 80% Good
- The level of usefulness of the tool in the career practice of the professionals: at least 80%

WP3 – Careers and Competence 4.0 Information & Assessment System

WP3 focuses on the design, development and implementation of an innovative and integrated digital ecosystem aimed at supporting the assessment and development of Industry 4.0–related competences. The methodological approach adopted within this work package combines principles of user-centred design, digital pedagogy and technological innovation in order to ensure both functional effectiveness and educational relevance.

Activity 3.1 involves the design of technical architecture and core system functionalities of the CAREERS 4.0 platform. This includes the development of a humanoid chatbot and an immersive metaverse environment based on cyber-physical systems and digital twin technologies. These digital components are designed to simulate realistic work-related contexts and interactions, enabling the

assessment of users' 4.0 skills through experiential and interactive processes. In addition, a physical educational card game is developed as a complementary support tool, facilitating blended learning approaches and increasing accessibility for diverse user groups.

Activity 3.2 focuses on content development and system integration. This includes the creation of 19 detailed occupational sector descriptions and the development of structured information content related to career planning and management, RIASEC profiles and Industry 4.0 enabling technologies. This validated content is used to train the humanoid chatbot and populate the metaverse environment with dynamic and interactive elements, such as avatars, information panels and digital twins of Industry 4.0 machines. Through engagement with these digital simulations, users are able to explore occupational contexts, reflect on their career interests and test their competences in realistic, scenario-based environments. The educational card game further supports experiential learning by illustrating the relationships between occupational sectors, RIASEC profiles and 4.0 technologies in an interactive and tangible format.

Activities 3.3 focus on the national testing, evaluation and dissemination of the CAREERS 4.0 digital ecosystem. The platform is piloted in each country, followed by the production of national testing and evaluation reports documenting usability, effectiveness and user satisfaction. Feedback collected from users and stakeholders is systematically analyzed and used to inform an iterative process of system refinement and improvement, ensuring the continuous enhancement of both technological performance and pedagogical value.

Quantitative and qualitative indicators for WP 3. The indicators that will be used for the measurement of the level of achievement of the WP 3 objectives and the quality of the result are:

Quantitative indicators concern:

- the number of career practitioners, trainers and relevant professionals participating in the pilot testing of the system: 5 professionals from the partner countries will take part in the pilot testing (25 professionals per partner).
- the number of youngsters and adults participating in the pilot testing of the system: 50 (10 per partner).
- overall number of users accessing the system
- the number of participants in the national workshops: 200 (40 per country)
- the completion rate, which measures the percentage of learners who start and successfully complete the program

Qualitative indicators concern:

- level of satisfaction of VET trainers and career professionals (expected rate 80%)
- level of youngsters and adults end users' satisfaction (expected rate 80%)
- user experience quality level (combination of QoS and QoE on user experience)

WP4 – Career Guidance 4.0 training program and new adapted career guidance 4.0 methodologies and practices for career practitioners

WP4 aims to enhance the professionalism, effectiveness and overall quality of career guidance, training and labour market inclusion services in the context of rapid technological and structural changes associated with Industry 4.0. The methodological approach adopted within this work package is grounded in principles of adult education, lifelong learning and competence-based training, and integrates competence development, curriculum design, digital learning delivery, certification procedures and systematic evaluation.

The first methodological step concerns the development of the Career Guidance 4.0 Provision Competence Profile, which defines specific qualification criteria and learning outcomes for career guidance practitioners, trainers and other professionals involved in labour market inclusion services. This process is informed by labour market analysis, European competence frameworks and emerging requirements related to digitalisation, advanced Labour Market Intelligence (LMI) and data-driven guidance practices. The competence profile serves as a reference framework for curriculum development and professional standards.

Building on this profile, the Career Guidance 4.0 Training Curriculum and Handbook are developed using a modular, learner-centred and competence-based approach. The curriculum integrates innovative career guidance methodologies, advanced LMI systems and tools, interpretation of labour market data (including dynamics related to jobs, skills and qualifications), as well as digital guidance instruments and platforms. The accompanying handbook provides methodological guidance, practical examples and instructional resources to support consistent and high-quality training delivery across partner countries.

To facilitate flexible and accessible learning pathways, an e-learning platform (e.g. Moodle) is developed to support distance and blended learning processes during the pilot implementation of the training. The platform hosts structured training materials aligned with the curriculum and handbook, interactive learning activities, self-assessment tools and communication features, ensuring learner engagement and continuity of the learning process.

A train-the-trainers activity is implemented to build the capacity of partnership staff to act as qualified multipliers of the training programme. This activity focuses on strengthening pedagogical, digital and methodological competences, ensuring that

trainers are adequately prepared to deliver the training in line with the project's quality standards and learning objectives.

The training programme is subsequently implemented in the partner countries, involving 90 professionals (15 per country) working in career guidance, training and social inclusion contexts. Training delivery is accompanied by clearly defined assessment and certification procedures, ensuring transparency, recognition of learning outcomes and alignment with the competence profile.

Finally, the effectiveness of the training is systematically evaluated through a mixed-methods approach combining quantitative feedback questionnaires and qualitative reflections from participants. The results are synthesized in a comprehensive report on training effectiveness, providing evidence of learning outcomes achieved, perceived relevance and areas for improvement.

Overall, the methodology adopted in WP4 ensures a coherent, evidence-based and quality-driven implementation of CAREERS 4.0, contributing to the professionalization of career guidance services and to more effective labour market inclusion practices for young people and adults in the context of Industry 4.0.

The achievement of the WP4 objectives will be measured through the following quantitative and qualitative indicators.

Quantitative indicators include:

- 1 Career Guidance Provision 4.0 Competence Profile
- 1 Career Guidance 4.0 Training Curriculum and Handbook
- 1 e-learning platform
- engagement of 25 career practitioners, trainers in A1 activity
- 5 Career Guidance 4.0 training (1 per country)
- engagement of 75 (15 per country) VET & career guidance professionals in the Career Guidance 4.0 training activity
- 1 assessment report on training results
- engagement of 10 (2 per country) experts in adult training / curriculum development for the evaluation of the first version of the training content.

Qualitative indicators include:

- The evaluation rate by the experts on the overall content: at least 80% Good
- The level of satisfaction of professionals involved concerning the training curriculum and training material: at least 80%
- The level of satisfaction of professionals involved concerning the e-learning tools
- Level of satisfaction of professionals involved concerning the training processes

- Level of usefulness of the whole training program in career guidance practice according to the professionals involved: at least 80%

3. Criteria of analysis corresponding to established outcomes of WP's

WP's	Main objective	Key activities	Main results	Quality assurance/ monitoring
WP1	Ensure effective project implementation, progress	- Establish Quality Assurance Team (CMBRAE) - Define roles, responsibilities, procedures - Continuous monitoring using PDCA cycle - web meetings - "Quality Check Points" quarterly - Partner internal reviews every 6 months	- Guidelines for Quality Assurance - Progress and evaluation reports - Corrective actions	- PDCA cycle implementation - Monitoring deadlines, deliverables and responsibilities - Data collection from partners, staff, beneficiaries - Expert review by QA&E team
WP2	Develop validated Career Competencies 4.0 Framework and psychometrically robust skills assessment battery	- Systematic review of European/international competence frameworks - Define knowledge, skills, attitudes, including non-cognitive competences - Design scenario-based assessment items - Expert review, cross-cultural adaptation, pilot testing - Standardisation and norming with 300 young people	- Career Competencies 4.0 Framework - Validated skills assessment battery - Technical manual of Assessment Tool	- Expert review of items - Back-to-back translation and pilot testing - Psychometric analysis: reliability, validity, internal consistency - Standardised scoring and norms (back-to-back translation)
WP3	Develop an innovative digital ecosystem for assessment and development of 4.0 skills	- Design technical architecture, humanoid chatbot, metaverse environment, card game - Create 19 occupational sector descriptions and content for RIASEC	- Fully functional digital platform - Metaverse environment with interactive avatars and digital twins	- User feedback analysis - Iterative system improvement - National pilot testing and workshops - QA review of content integration and usability

		profiles - Integrate content into platform and metaverse - National testing, evaluation, dissemination events	- Card game - National evaluation reports	
WP4	Enhance professionalism of career guidance services and support labour market inclusion	- Develop Competence Profile for practitioners - Create Training Curriculum and Handbook - Develop e-learning platform - Conduct train-the-trainers activities - Implement training and certification for go professionals - Evaluate training effectiveness	- Competence Profile for practitioners - Training Curriculum and Handbook - E-learning platform with structured training content - Certified professionals - Training effectiveness report	- Participant feedback questionnaires - Evaluation of learning outcomes - QA monitoring of curriculum and training delivery - Certification procedures aligned with Competence Profile

4. Key Conclusions

CAREERS 4.0 Work Packages related to the established outcomes aims at the following aspects:

- WP1 – Project Management is focused on effective coordination, accountability and continuous quality improvement across all project activities.
- WP2 – Career Competencies 4.0 Framework and Adequate Psychometric Skill Assessment Questionnaires is designed to deliver a scientifically robust competence framework and validated, standardised skill assessment tools.
- WP3 – Careers and Competence 4.0 Information & Assessment System has the objective of developing an innovative digital ecosystem, integrating chatbot guidance, metaverse environments, digital twins and experiential learning tools.
- WP4 – Career Guidance 4.0 Training Program and New Adapted Career Guidance 4.0 Methodologies and Practices for Career Practitioners is committed to strengthen professional capacities through a competence-based training programme, e-learning platform and certification.

Overall, the CAREERS 4.0 project proposes a coherent, high-quality and sustainable outcomes, contributing to the modernisation of career guidance and employability support in the context of Industry 4.0.

This present methodology sets out to improve the activities foreseen in the project application from the proactive perspective and to generate new ideas for future projects.

The methodology is designed not as a tool for sanctioning, but as a framework to systematically enhance the quality of project activities. It seeks to optimize the use of all available resources, ensuring that each stage of implementation is carried out efficiently and effectively. By embedding continuous monitoring, evaluation, and feedback mechanisms, the methodology supports ongoing improvement, fosters innovation, and promotes adherence to high standards.

Its ultimate objective is to achieve outcomes of the highest quality, delivering sustainable, impactful, and replicable results that reflect both professional excellence and alignment with best practices in career guidance, skills development, and Industry 4.0 competencies.