STAFFER
EUROPEAN RAIL SKILLS ALLIANCE

Assessment of employability and career opportunities from the point of view of Railway Suppliers

DELIVERABLE D 5.3

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TABLE OF CONTENTS

TABLE OF FIGURES

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LIST OF TABLES

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
EQF	European Qualifications Framework
E&T	Education and Training System
HR	Human Resource
RACER	Relevant, Accepted, Credible, Easy and Robust
WP	Work Package
UB	University of Belgrade
FH Erfurt	University of Applied Science of Erfurt
HSTS	Hitachi rail
M	Month

1 INTRODUCTION & OBJECTIVES

1.1 INTRODUCTION

Work package (WP) 5 "Validation of mobility and training programs for effectively increasing employability and career opportunities" is part of phase two of the STAFFER project (under section: mobility and training program design and implementation) together with the following work packages:

- WP4: Development of mobility and programs
- WP5: Validation of mobility and training programs to effectively increase employability and career opportunities
- WP6: Implementation of training and mobility programs

Figure 1 summarizes the interconnections between the work packages, including how does WP5 fit in the overall structure and objectives of the project.

The purpose of overall WP 5 is to transfer and validate the new and/or updated mobility and training paths, programs and curricula developed in Tasks 4.4 and 4.5 with the specific goal to increase employability and career opportunities of young professionals according the covered EQF levels. This WP adopted an approach similar to the one considered for WP 1, WP 2, and WP 3. First, a methodological umbrella was developed in Task 5.1; then, in parallel, the assessment of employability and career opportunities was performed by rail operators and infrastructure managers in Task 5.2, and by rail suppliers in Task 5.3. To guarantee a coherence of the approaches in the validations, Tasks 5.2 and 5.3 have worked in a strict contact by applying the same methodology. Following Tasks 5.2 and 5.3, in the next step, Task 5.4 will focus on comparison and synthesis of the work and as its output will provide a feedback mechanism to better tune the mobility and training programmes developed in Tasks 4.4 and 4.5. Figure 2 provides visual summary of the WP 5 and its tasks.

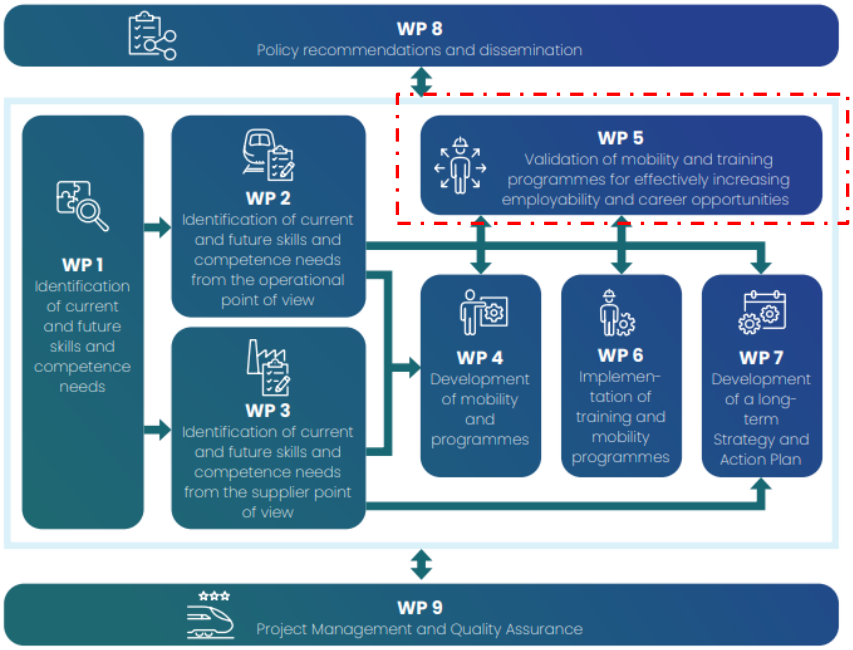

FIGURE 1 STAFFER PROJECT STRUCTURE WITH INCLUSION OF WP5

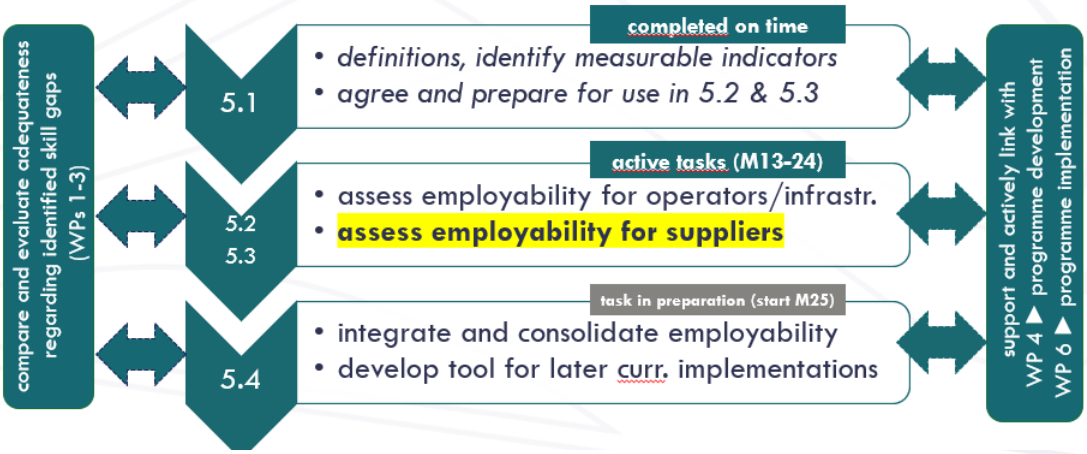

FIGURE 2 INPUT AND OUTPUT INTERFACES TO WP5

1.2 OBJECTIVES OF TASK 5.3

Task 5.3 under title: *Assessment of employability and career opportunities from the point of view of suppliers* was active during the following period of the STAFFER project: M13 – M24. The leader of the Task was Alstom and the following participants , including railway suppliers and E&T providers have actively participated and contributed to the Task: UB, FH Erfurt, Alstom, CAF, HSTS, MAFEX, SIEMENS MOBILITY. This task was aimed at applying the methodologies and criteria developed in Task 5.1 to the mobility and training programs, as well as to the teaching methodologies by considering specific point of view of suppliers. In doing so, the

validation has also addressed those training and education practices that have been identified in the context of the general trend identified in WP 1 and the specific skill needs identified in WP 3.

1.3 STRUCTURE OF TASK 5.3

In order to achieve its objectives, the Task 5.3 has been structured around the following key milestones and approached in two phases: conceptualization (with key goal to scope the task deliverables and to select the most relevant assessment methodology) and operationalization (with focus on running the pilot assessments, results analysis and derivation of conclusions):

Phase A: Conceptualization

1. Scoping (sizing the scope of the project) which included:
    a. Selection of key occupational profiles (based on WP3 deliverable)
    b. Selection & complementing employability assessment indicators (based on WP 5.1, WP 3)
2. Selection of the assessment methodology (incl. methodology alignment with WP5.2)

Phase B: Operationalization

3. Run pilot assessments of existing training courses, programs, courses of study
4. Adjust methodology, based on pilot assessment results, as required
5. Results synthesis and analysis
6. Preparation for a method application in the development and implementation phases (WP4 and WP6) of newly designed training courses, programs, courses of study in Task 5.4

1.4 EXPECTED OUTCOMES OF TASK 5.3

As part of the task structure, milestones & methodology discussion, the task participants have also discussed what the expected outcomes should be, which can be summarized as follows (Fig.3)

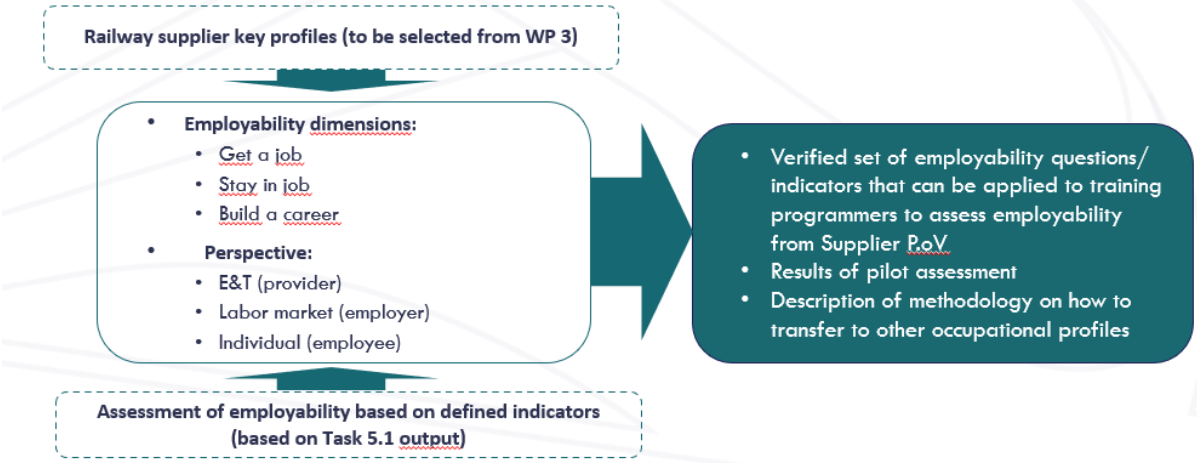

FIGURE 3 EXPECTED OUTCOMES OF TASK 5.3

The task has identified key target occupational profiles which will be basis for the assessment, based on the WP 3 inputs. As the basis for the as assessment tool, the task has utilized the list of employability indicators that have been put together by Task 5.1.

In order to integrate various perspectives, when it comes to employability assessment, selected methodology must include: E&T providers, Labour market (employer) and individual (employee). Additionally, the questions included in the employability assessment should have covered various dimensions of employability: getting a job, staying in the job and building a career. With the following criteria and inputs defined, the expected outcomes of the pilot assessments were:

- Verified set of employability questions & indicators that can be applied going forward to current and future training programs to assess their employability from the point of view of supplier
- Summary results of the pilot assessment
- An overall description of methodology on how to transfer the employability assessment toolkit to other occupational profiles as input for Task 5.4

2 SCOPING

As part of the scoping of the project, the following two milestone have been agreed:

- Selection of key occupational profiles (based on WP3) which will be the focus of assessment in the Task 5.3 (due to a large number of overall occupational profiles identified in WP3, it was not feasible to focus on all).
- Selection & complementing employability assessment indicators (based on WP 5.1, WP 3) to ensure the employability assessment tool includes questions and indicators

that are identified as critical and relevant from a point of view of supplier (since the original list of questions and indicators covered various perspectives and points of view it was important to tailor it to the needs of suppliers.

2.1 Selection of target occupational profiles

In order to assess the employability of the training programs from a perspective of railway suppliers, one of the first actions of the Task 5.3 was to select key occupational profiles that will be a target group for such employability assessment. Based on the WP 3 deliverable, that has provided a detailed summary of all occupational profiles in the rail supply and manufacturing industry, the following criteria were agreed by the task participants to identify the target profiles:

1. **Criticality of profile from supplier's perspective**
2. **Scarcity of the profiles on the market**

Each of the participants have reviewed the list of occupational profiles and has provided its assessment & prioritization of the most critical ones based on the agreed criteria above. The following occupational profiles were selected for Task 5.3 as focus group (based on majority input) :

- **Systems engineers**
- **Software engineers**
- **Vehicle architects**

2.2 Review of the employability assessment tool & its indicators

Task 5.3 has relied on the deliverable of Task 5.1, in which a methodological (and theoretical) umbrella for the evaluation of training and mobility programs with focus on employability has been developed. It included a detailed theoretical construct of employability (conception phase) and a set of quantitative and qualitative indicators for measuring employability (operationalization phase).

In the concept phase, the UB team (leader of Task 5.1) carried out a literature review on common definitions of employability, agreed on a definition of employability within the STAFFER project and created a conceptual framework of employability with:

- three dimensions "get a job", "stay in job", "build a career" and

- two criteria "Enabler" (Input & Process) and "Results" (Output & Outcome).

In the operationalization phase, a set of measurable indicators for the theoretical construct were developed. In two survey phases within the Task 5.1, the working group consolidated it to a final set of indicators/metrics.

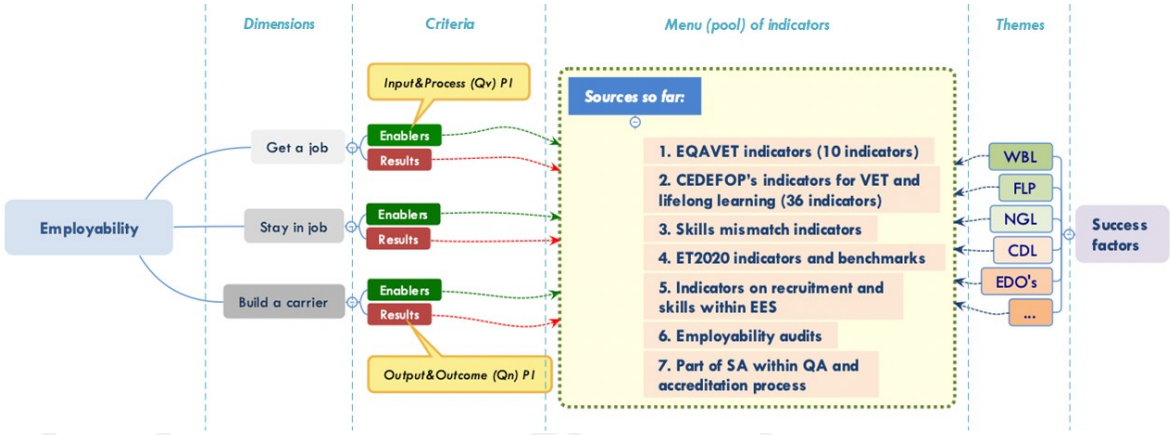

FIGURE 4 TASK 5.1 POSITIONING OF INDICATORS IN THE CONCEPTUAL FRAMEWORK

(Abbreviations: Qv – Qualitative, Qn-Quantitative, PI-Performance Indicator, WBL-Work Based Learning, FLP-Flexible Learning Pathways, NGL – Next Generation Learning, CDL – Carrier Development Learning, EDO's – Employment Development Opportunities, EES-Employer Establishment Surveys, SA-Self Assessment, QA-Quality Assurance)

As a result of Task 5.1 research and work, a list of employability indicators and questions has been developed. In principle, it is a questionnaire that investigate the uptake of employability elements within program content. It focuses on the success factors i.e., elements that are seen with strong positive impact on employability. It is a developmental tool, the aim is not to comply with the overall score or use it to use it in a "league table" but decompose it to track fields of action and improvement (ref. Task 5.1)

Task 5.3 has then used the extended list of employability indicators and questions as a basis for building its employability assessment tool, from a perspective of railway suppliers. Each indicator and question were assessed from perspective of relevancy, acceptance, credibility, easy to understand and robustness. Following suppliers' review of employability indicators , 67 indicators have been selected under the following 6 dimensions:

- **Employability within curriculum**
- **Employment development opportunities**
- **Career development and learning support**

- **Partnership with employers**
- **Options for work experience**
- **Development and support in personal skills**

Both the dimensions as well as the rating scale has been aligned with Task 5.2 to ensure cross-comparison and results synthesis by Task 5.4 The employability questions and indicators however have been tailored to focus on the perspective of railway suppliers.

3 ASSESSMENT METHODOLOGY

As part of the methodology selection it has been raised by the task partners that the selected assessment methodology should ensure all of the perspectives are covered: Education & Training provider, employer and employee.

Therefore, it has been agreed to proceed with a hybrid methodology approach: survey and in depth/expert interviews. This approach has allowed, on one side, to verify and test the identified employability indicators and, on the other side, to gain additional insights into employability factors via in depth interviews.

It has been decided to apply the survey method to collect employability assessment on the existing training programs with E&T providers and to run in depth interviews with supplier representatives (employer perspective).

For the survey, the employability assessment tool has been used with the pre-selected by suppliers' employability indicators and questions. For the in depth interview, a set of 9 questions have been defined to gain additional insights on employability from perspective of employers. The questions were clustered by employability dimensions (getting a job, staying in the job and building a career).

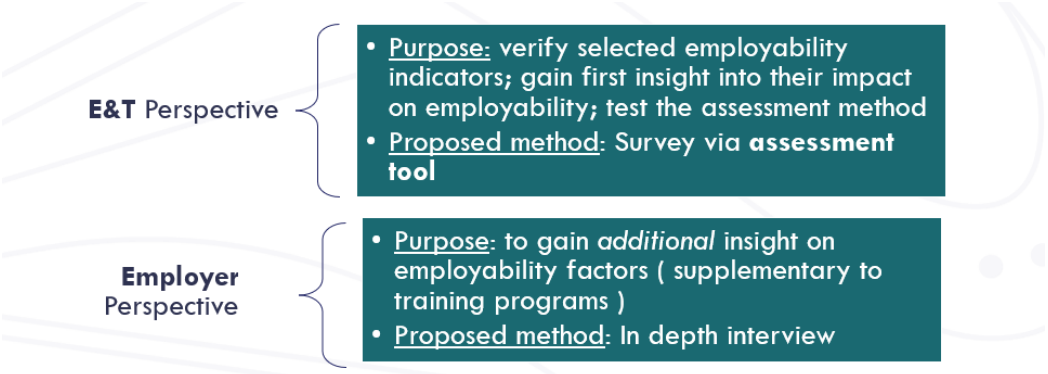

FIGURE 5 EMPLOYABILITY ASSESSMENT METHODOLOGY

4 PILOT ASSESSMENTS

4.1 Objective of the pilot assessments

The objectives of the pilot assessment were to 1) test (and if needed, adjust) the selected methodology before applied to larger scope. It is an essential step for assessing training programs and courses of study in order to test of the applicability of evaluation method, questions& indicators and the ability to analyze the results in recognizing optimization needs as well as to 2) gain the first insights with regards to the employability of the selected pilot programs in terms of employability score (low/medium/high contribution to increasing employability)

4.2 Pilot group criteria

The following criteria have been set for the identification of the pilot programs that should be considered in the pilot phase of the employability assessment:

- Focus of the pilot assessment should be on *existing* training programs
- Pilot programs should cover broad European geography (at least 3 countries)
- Pilot programs should cover all 3 selected target profiles
- Pilot programs should be part of STAFFER project (to simplify access to data)
- Pilot program will cover EQF levels 6-8 (whiles Task 5.2 focused on lower EQF levels, which will allow testing of the employability tool for programs across all EQF levels).

4.3 Execution of pilot assessments

In order to identify training programs for participation in the pilot assessment, a call for support has been issued to all participating E&T partners of the STAFFER project. The focus was on the training programs that cover the target profiles: systems engineers, software engineers and vehicle architects.

The following programs have been identified and agreed to participate in the pilot phase (see Fig 6). Most of the criteria set for the pilot group have been met, except for profiles covered (all of the pilot programs focused on system engineering only). Additionally, it was decided to focus on E&T perspective only and to cover the perspective of employee in Task 5.4 as part of

long term assessment of employability (during studies, after graduation and following several years in the profession).

Program	Country	Covered profile
University 1	Germany	Systems Engineer
University 2	Austria	Systems Engineer
University 3	Austria	Systems Engineer
University 4	Italy	Systems Engineer

Limitations:
- Only 1 of 3 profiles covered as part of pilot;
- Employee perspective not covered

FIGURE 6 SELECTED PROGRAMS FOR THE PILOT ASSESSMENTS

The pilot participants have then received a blank employability assessment tool form together with detailed instructions on their program assessment. The goal was, for each pilot participant, to answer the questions/provide rating on all employability indicators assessing the training program from a perspective of E&T provider.

4.4 Pilot assessment results

The figure 7 summarizes the results of the assessed pilot programs. In summary, each pilot program has identified space for improvement (none of the dimensions were rated 5) in terms of improving employability of the program. On the other hand, only few dimensions rated low (below 3) including *options for work experience* and *development and support in personal skills*.

Dimension *options for work experience*_received lowest assessment rate for both Masters programs, questions included:

- Apprenticeships and traineeships provided and encouraged as part of program
- Consideration of new forms of placements (i.e virtual internships)
- Minimum length of work experience is clearly identified within programs

Additionally, although dimension *employability within curriculum* received above average rating, for 3 out of 4 programs, the following indicator received low scoring: *Regular assessment of ability to write clear, concise, and correct English*.

Indicator (Dimension) name	Ø rating
1. Employability within curriculum	3,5
2. Employment development opportunities	4,0
3. Career development learning and support	3,6
4. Partnership with employers	4,5
5. Options for work experience	2,8
6. Development and support in personal skills	3,6

Indicator (Dimension) name	Ø rating
1. Employability within curriculum	3,4
2. Employment development opportunities	4,0
3. Career development learning and support	3,2
4. Partnership with employers	4,5
5. Options for work experience	3,8
6. Development and support in personal skills	3,8

Indicator (Dimension) name	Ø rating
1. Employability within curriculum	3,1
2. Employment development opportunities	4,6
3. Career development learning and support	4,0
4. Partnership with employers	4,6
5. Options for work experience	4,3
6. Development and support in personal skills	2,7

Indicator (Dimension) name	Ø rating
1. Employability within curriculum	3,9
2. Employment development opportunities	3,8
3. Career development learning and support	3,8
4. Partnership with employers	4,4
5. Options for work experience	2,9
6. Development and support in personal skills	4,1

FIGURE 7 SUMMARY OF THE PILOT PROGRAMS EMPLOYABILITY ASSESSMENT

Lastly, a number of questions were rated as *Not applicable* by pilot participants (Ref Fig 8). The reasons included: unclear wording and no relevancy for specific program. As part of employability assessment toolkit improvement the questions were revised and updated.

Dimension		Question
1. Employability within curriculum	1.09	Do learners have a choice of modules or choice of work areas within a module so they can tailor the content of their course to their perceived needs/interests?
2. Employment development opportunities	2.05	Are learners regularly informed about open employment opportunities (e.g. through annual job fairs or similar activities)?
3. Career development learning and support	3.03	Do learners/trainees get help with producing/improving a CV and letters of application for employment??
3. Career development learning and support	3.04	Can learners easily switch to another pathway or plan of study or combine different modules or work areas?
3. Career development learning and support	3.05	is there a career support services available ?
5. Options for work experience	5.06	Are realistic simulations used to give experience of real work situations?
6. Development and support in personal skills	6.29	Software specification analysis
6. Development and support in personal skills	6.32	Ability to perform scientific research
6. Development and support in personal skills	6.33	Usage of software configuration management tools
5. Options for work experience	5.01	Have you identified where work related learning activities take place in the course and are these made explicit to learners?
6. Development and support in personal skills	6.23	Customer orientation
6. Development and support in personal skills	6.29	Software specification analysis

FIGURE 8 LIST OF EMPLOYABLITY QUESTIONS RATED AS N/A BY PILOT PARTICIPANTS

All in all, no major gaps were identified in programs participating in the pilot group; some have identified dimensions with potential areas for improvement / increase in employability of the pilot programs. The task 5.3 confirmed that the tool provides a first insight into employability factors per program and their assessment; further deep-dive per program & dimension would be required to explore how the program can be improved . For tool usage going forward, some adjustment have been implemented (wording, additional explanations, technical improvements)

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4.5 Pilot assessment limitations

It is important to mention the limitation of the pilot assessment performed:

- Only systems engineering programs participated in the pilot; tool was developed with focus on 3 profiles (systems engineers, software engineers and vehicle architects); however questions can be completed/adjusted to cover further profiles
- Employee perspective was not covered; however, it is to be considered for future tool usage as well as to compare the assessment between E&T provider and Employee for the same program

5 EMPLOYER INTEVIEWS

In the second phase of employability assessment from point of view of suppliers, expert interviews were performed to gain insight into additional employability factors from the point of view of employers. In total, 12 interviews were conducted by suppliers in the Task 5.3 (Fig 10).

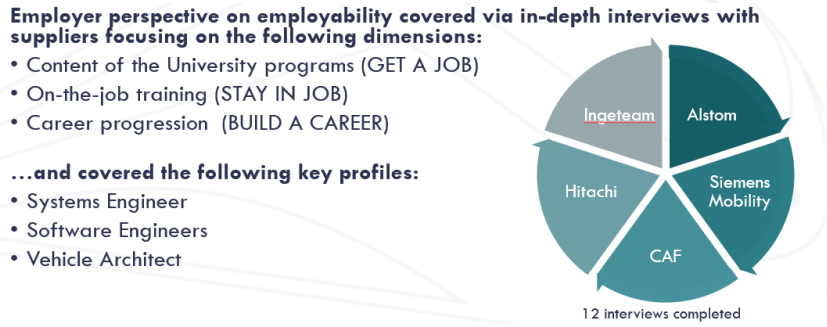

FIGURE 9 EMPLOYER PERSPECTIVE ON EMPLOYABILITY. EXPERT INTERVIEWS

5.1 Summary of the interview results

In total, 9 questions were asked during the interviews. The questions were clustered around three dimensions of employability: getting a job, staying in the job and building a career.

For the interviews, all target job profiles were covered: systems engineers , software engineers and vehicle architects, however the focus of responses was on *employer* perspective. Employee perspective needs to be integrated as part of Task 5.4 continued work to ensure comprehensive view on employability. Important to mention that during the interviews, it was not the specific

training programs that have been assessed for employability but rather the intention was to cover general perspective of employability from employers related to the identified profiles, since training programs are only one element that has impact on employability (i.e among others there are market, economic and social factors)

In summary, missing or not enough work experience in the rail industry has been identified as a major employability factor raised by all interviewees for all profiles discussed. Similarly, the same feedback was provided during the pilot assessment with E&T providers who saw opportunities for work experience as dimension that requires improvement in the program. Since this employability dimension has been raised from both employer and E&T perspectives, underlying its importance to employability as well as emphasizing today's gap, it is a key element to be considered in improving the profiles' employability and should be considered as one of the inputs into the policy recommendation paper. Additionally, in terms of competencies & skills, high relevance of system engineering competences (interface mgmt., safety functions, lifecycle interdependencies) and IT skills (software, security, control). were highlighted as critical for improving employability. On-the job training has also been identified by all interviewers as an essential part of increasing employability in rail industry, as it takes between .5 -10 years to build a fully- fledged profile (depending on the role). The results of both: pilot assessments and interviews have confirmed overall need for more work experience, more in depth knowledge related to systems engineering as well as more focus on English language. These outcomes should be considered for existing program reviews as well as new program developments as well as reflected in the policy recommendation.

The next section provides a more detailed summary of the interviews.

6 SUMMARY AND INPUT FOR TASK 5.4

In summary, in Task 5.3 the working group has successfully achieved its expected objectives:

the list of employability indicators has been reviewed and validated from perspective of railway suppliers. The list of employability indicators has been turned into a employability assessment tool which can be tailored to different profiles, perspectives and can be generally applied to various training programs to regularly assess the programs and identify areas for improvement. The methodology and tool have therefore been successfully tested and can be recommended for future use.

Since the methodology and overall approach have been synchronized and aligned with Task 5.2, this will allow the Task 5.4 to provide an integrated overview & validation of employability and career opportunities, putting special emphasis on "customer validation" that the revised curricula and their implementations actually meet the identified skills gaps and competency needs. The assessments and validated tools developed in Task 5.3 will serve as enabler for Task 5.4 to continue practical testing of the assessment tool to cover employee perspective (which was not addressed in Task 5.3), support the transfer of the tool to a broader application and continue application of the assessment tool to the selected programs.

6.1 Evaluation of the method & assessment tool

In Task 5.3 a hybrid assessment method has been selected with surveys (in form of assessment tool) and interviews to be performed. This approach has allowed for more comprehensive evaluation employability of the selected profiles and programs. The selected method has not considered the perspective of employees/students, however this will be a recommendation for Task 5.4 to ensure perspective is integrated in the consolidated evaluation method.

The analysis of the results of evaluated programs can be used for design approaches both in the context of qualification development as well as for the further development of implemented qualification measures. In accordance with the task of an assessment of employability and career opportunities from the point of view of railway suppliers, evaluation method and assessment tool were successfully developed. The WP work will now continue via Task 5.4 to

further synthesize the outcomes of Task 5.2 and Task 5.3 with the objective to develop integrated long term perspective on the employability assessment of the programs as well as to ensure employee perspective is covered in different phases of employment: get a job (during /after studies), stay in job (ongoing skills development) and building a career.

TABLE 1: OCCUPATIONAL PROFILES OVERVIEW: VEHICLE ARCHITECTURE, SOFTWARE ENGINEERS, SYSTEMS ENGINEERS (EXTRACT FROM D3.2)

Vehicle Architecture (Rolling Stock Engineer, 2144.1.18) – Job Group: Mechanical Engineers (2144.1)		
Rolling stock engineers design and oversee the manufacturing process and installation of rail vehicles, including locomotives, carriages, wagons and multiple units. They design new trains and electrical or mechanical parts, supervise modifications and resolve technical problems. They also perform routine maintenance duties to ensure that trains are in good condition and meet quality and safety standards.		
Skills and competences – essential		
adjust engineering designs	assess financial viability	execute feasibility study
analyse production processes for improvement	control compliance of railway vehicles regulations	perform scientific research
approve engineering design	control production	use technical drawing software
Skills and competences – optional		
apply advanced manufacturing	develop test procedures	manage product testing
build a product's physical model	draft design specifications	perform test run
conduct performance tests	ensure maintenance of railway machinery	record test data
create a product's virtual model	ensure maintenance of trains	use CAD software
design electromechanical systems	maintain electromechanical equipment	use CAM software
design prototypes		
Knowledge – essential		
engineering principles	manufacturing processes	quality standards
engineering processes	production processes	technical drawings
industrial engineering		
Knowledge – optional		
CAE software	electromechanics	mechanics of trains
design principles	electronics	precision mechanics
electrical engineering	mechanical engineering	
http://data.europa.eu/esco/occupation/7c2fbf7d-b934-4f62-8167-0ed90fb2a16f		

System Engineers (ESCO competence)		
ESCO has no profile for System Engineers defined. Systems engineering is an interdisciplinary turf of engineering and engineering management that centers around on how to design and manage composite systems over their life cycles. The systems engineer plays a vital role in the multi-dimensional computer world. Primarily they define the customer's or stakeholder's needs and essential functionality in the early stages of product or service development cycle. Systems Theory: The principles that can be applied to all types of systems at all hierarchical levels, which describe the system's internal organisation, its mechanisms of maintaining identity and stability and achieving adaptation and self-regulation and its dependencies and interaction with the environment. The following description of ESCO´s definition for Embedded systems software developer (2514.2.1/ Job group: ICT application developer, 2512.2) could specify some skills, competences, and knowledge, which could correspond with system engineers: Embedded systems software developers program, implement, document and maintain software to be run on an embedded system.		
Potential skills and competences – essential		
analyse software specifications create flowchart diagram debug software develop ICT device driver	develop software prototype interpret technical texts provide technical documentation	use software design patterns use software libraries utilise computer-aided software engineering tools
Potential skills and competences – optional		
adapt to changes in technological development plans collect customer feedback on applications design user interface develop automated migration methods	develop creative ideas integrate system components use automatic programming use concurrent programming	use functional programming use logic programming use object-oriented programming
Potential knowledge – essential		
ICT debugging tools Internet of Things	computer programming embedded systems	integrated development environment software tools for software configuration management
Potential knowledge – optional		
ABAP	Jenkins (tools for software configuration management)	KDevelop

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AJAX APL ASP.NET Ansible Apache Maven Assembly (computer programming) C# C++ COBOL Common Lisp Eclipse (integrated development environment software) Groovy Haskell ICT security legislation Java (computer programming) JavaScript	KDevelop Lisp MATLAB ML (computer programming) Microsoft Visual C++ Objective-C OpenEdge Advanced Business Language PHP Pascal (computer programming) Perl Prolog (computer programming) Puppet (tools for software configuration management) Python (computer programming) R Ruby (computer programming)	Lisp MATLAB ML (computer programming) Microsoft Visual C++ Objective-C OpenEdge Advanced Business Language PHP Pascal (computer programming) Perl Prolog (computer programming) Puppet (tools for software configuration management) Python (computer programming) R Ruby (computer programming)
https://www.fieldengineer.com/skills/systems-engineer http://data.europa.eu/esco/occupation/57af9090-55b4-4911-b2d0-86db01c00b02 http://data.europa.eu/esco/skill/cdd8b6b2-2fd9-453c-8d62-8a1dc6efcd49		

Software Engineers (Software Developer – 2512/ 2512.3) – Job Group: Software and applications developers and analysts (251)		
Software developers research, analyse and evaluate requirements for existing or new software applications and operating systems, and design, develop, test and maintain software solutions to meet these requirements. Tasks include: (a) researching, analysing and evaluating requirements for software applications and operating systems; (b) researching, designing and developing computer software systems; (c) consulting with engineering staff to evaluate interfaces between hardware and software; (d) developing and directing software testing and validation procedures; (e) modifying existing software to correct errors, to adapt it to new hardware or to upgrade interfaces and improve performance; (f) directing software programming and development of documentation; (g) assessing, developing, upgrading and documenting maintenance procedures for operating systems, communications environments and applications software; (h) consulting with customers concerning maintenance of software systems. Software developers implement or program all kinds of software systems based on specifications and designs by using programming languages, tools, and platforms.		
Skills and competences – essential		
analyse software specifications	develop software prototype	provide technical documentation
create flowchart diagram	identify customer requirements	use software design patterns
debug software	interpret technical requirements	use software libraries
define technical requirements	manage engineering project	use technical drawing software
develop automated migration methods	perform scientific research	utilise computer-aided software engineering tools
Skills and competences – optional		
adapt to changes in technological development plans	integrate system components	use functional programming
collect customer feedback on applications	migrate existing data	use logic programming
design user interface	use automatic programming	use object-oriented programming
develop creative ideas	use concurrent programming	utilise machine learning

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Knowledge – essential		
ICT debugging tools	engineering processes	technical drawings
computer programming	integrated development environment software	tools for software configuration management
engineering principles	project management	
Knowledge – optional		
ABAP	Internet of Things	R
AJAX	Java (computer programming)	Ruby (computer programming)
APL	JavaScript	SAP R3
ASP.NET	Jenkins (tools for software configuration management)	SAS language
Ansible	KDevelop	STAF
Apache Maven	Lisp	Salt (tools for software configuration management)
Assembly (computer programming)	MATLAB	Scala
C#	ML (computer programming)	Scratch (computer programming)
C++	Microsoft Visual C++	Smalltalk (computer programming)
COBOL	Objective-C	Swift (computer programming)
CoffeeScript	OpenEdge Advanced Business Language	TypeScript
Common Lisp	PHP	VBScript
Eclipse (integrated development environment software)	Pascal (computer programming)	Visual Studio .NET
Erlang	Perl	World Wide Web Consortium standards
Groovy	Prolog (computer programming)	Xcode
Haskell	Puppet (tools for software configuration management)	object-oriented modelling
ICT security legislation	Python (computer programming)	software anomalies
http://data.europa.eu/esco/occupation/f2b15a0e-e65a-438a-affb-29b9d50b77d1		