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PROFESSIONAL PROFILE MAP AS A POWERFUL EDUCATIONAL TOOL FOR ARCHITECTS AND CIVIL ENGINEERS

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Abstract
The paper discusses the importance of the Professional Profile Map (PPM) in the context of architecture and civil engineering education. It acknowledges the dynamic nature of these fields due to technological advancements and evolving industry practices, emphasizing the need for professionals who possess practical skills in addition to academic knowledge. The PPM is introduced as a valuable tool that acts as a bridge between academia and industry by defining the essential knowledge, skills, and competencies (KSC) required for success in these professions. Furthermore, the paper discusses the role of the PPM in Erasmus+ projects, highlighting its ability to facilitate customization and adaptability in education. It encourages interdisciplinary collaboration, practical experience, and employability enhancement, aligning with the goals of Erasmus+ projects. A case study from the TAB4BUILDING project illustrates how the PPM was used to identify KSC related to the use of Fibre Reinforced Polymers (FRP) in construction. The PPM's role in harmonizing educational programs across different countries and promoting international collaboration is emphasized.

Keywords: **Core proficiencies; Educational Tool; Fibre Reinforced Polymers (FRP); Knowledge, skills, and competences (KSC); Professional Profile Map (PPM).**

1. INTRODUCTION

The field of architecture and civil engineering plays a crucial role in shaping the infrastructure and built environment of societies. With rapidly advancing technologies and evolving construction practices, the education of architects and civil engineers must keep pace to produce professionals who are not only academically competent but also equipped with the practical skills and knowledge required in the industry. The Professional Profile Map (PPM) emerges as a valuable tool in this context, offering a comprehensive and adaptable framework for the education and training of these professionals [1].

2. PROFESSIONAL PROFILE MAP (PPM)

2.1. Definition

The Professional Profile Map is a strategic tool designed to bridge the gap between academia and industry, ensuring that graduates possess the requisite knowledge, skills, and competencies (KSC) needed for success in the professional world. It serves as a roadmap, delineating the core proficiencies and capabilities that architects and civil engineers should acquire during their educational journey and beyond.

This tool facilitates the alignment of learning outcomes, curriculum development, and assessment methods, ensuring that educational programs produce graduates who are not only academically proficient but also equipped with the practical skills demanded by the job market. It aids in the identification of skill gaps, enabling educational institutions to adapt swiftly to industry changes and provide targeted training to address those gaps.

2.2. Methodology for the development of a PPM

The methodology for the development of a Professional Profile Map involves a systematic and collaborative approach that aligns educational objectives with industry requirements [2]. It typically begins with a comprehensive analysis of the specific field or profession in question, such as architecture and civil engineering, by engaging experts, stakeholders, and practitioners. This initial phase involves identifying the key knowledge areas, essential skills, and competencies that professionals should possess. Subsequently, a structured framework is designed, often with input from international best practices and frameworks like the European Qualifications Framework (EQF) or relevant industry standards. The methodology emphasizes a learning outcomes approach to ensure transparency and flexibility, allowing for the adaptation of the map across various national contexts. Data collection methods such as interviews, surveys, and analysis of real-world work processes may be employed to validate and refine the map. Throughout the development process, ongoing collaboration between academia and industry is crucial to ensure that the resulting Professional Profile Map remains relevant, up-to-date, and reflective of the dynamic nature of the profession.

2.3. Role of the PPM in education

The Professional Profile Map plays a crucial role in education, particularly in vocational and professional training contexts. Its primary roles in education include:

- **Alignment of Curriculum**: The PPM serves as a guide for educational institutions in aligning their curriculum with the specific knowledge, skills, and competencies (KSC) required in a particular profession or industry. It ensures that educational programs are relevant to the needs of employers and the job market.
- **Learning Outcomes Definition**: It helps in defining clear and measurable learning outcomes for students. These outcomes are specific achievements or skills that students should acquire during their educational journey. This clarity benefits both educators and learners by providing a well-defined path to success.
- **Skill Gap Identification**: The PPM aids in identifying skill gaps in the workforce, which can be valuable for educational institutions. By understanding which KSC are in demand but lacking in the workforce, institutions can develop programs to bridge these gaps and produce graduates who meet industry needs.
- **Curriculum Development**: It guides the development of courses, training programs, and learning materials. Educators can use the PPM as a blueprint to design and structure their courses, ensuring that they cover the necessary content and skills.
- **Assessment and Evaluation**: The PPM supports the design of assessment methods that align with the defined learning outcomes. This ensures that students' progress and achievements can be effectively measured and evaluated.
- **Quality Assurance**: It contributes to maintaining and improving the quality of education by setting clear standards for what students should learn and

achieve. It facilitates continuous improvement processes within educational institutions.

- **Career Guidance**: The PPM can be a valuable tool for career guidance counsellors and students. It helps students understand the specific skills and qualifications required for their chosen profession, aiding in career planning and decision-making.
- **Industry Relevance**: By keeping educational programs aligned with industry demands, the PPM helps institutions produce graduates who are readily employable and can contribute effectively to their respective fields.
- **Flexibility**: The PPM is adaptable, allowing educational institutions to modify their programs in response to changing industry needs, technological advancements, and evolving trends.

Furthermore, the PPM promotes transparency and flexibility in education, allowing for the adaptation of programs to various national contexts and the incorporation of emerging trends and technologies. It acts as a compass for career guidance, helping students make informed decisions about their educational and career paths [3].

In essence, the Professional Profile Map serves as a dynamic and invaluable tool in the realm of education, driving the creation of a highly skilled workforce that is responsive to the ever-changing demands of the professional world.

2.4. Role of the PPM in Erasmus+ projects

Erasmus+ projects encourage customization and adaptability in education. The PPM is not a one-size-fits-all solution but a flexible framework that can be tailored to the specific needs and goals of each participating institution. This adaptability allows universities and colleges to design curricula that are both responsive to local context and globally relevant.

The PPM, as integrated into Erasmus+ projects, encourages interdisciplinary collaboration and learning. Architecture and civil engineering are no longer a solitary profession; they require collaboration with experts from other disciplines. Erasmus+ partnerships facilitate the development of joint programs and courses that expose architecture and civil engineering students to a holistic understanding of complex projects and promote teamwork.

Erasmus+ projects often emphasize practical experience through internships, cooperative education programs, and study abroad opportunities [4]. The PPM complements these experiences by providing a structured framework for evaluating the skills and competencies gained during hands-on projects. This ensures that students not only have theoretical knowledge but also practical expertise.

One of the primary goals of Erasmus+ projects is to enhance employability. The PPM plays a pivotal role in achieving this goal by aligning educational outcomes with industry requirements. Graduates are better prepared to meet the demands of potential employers, making them highly sought after in the job market. Moreover, the PPM's adaptability allows professionals to continue refining their skills throughout their careers, promoting lifelong learning and career development.

3. CASE STUDY – INSIGHTS FROM ERASMUS+ PROJECT

An example of a project in which PPM was used is the project TAB4BUILDING – Training for architects and builders in the use of composites for the building sector. The aim of the project was to develop a common training for both target groups, that let them increase their skills in the knowledge and application of FRP in the construction sector. One out of three Intellectual Outputs was the development of the Professional Profile Map.

In this case, the role of the PPM was to provide an overview which will help the construction industry to find the requested competences and concise overview of knowledge, skills and competences (KSC) related to the use of FRP [5]. To be innovative and applicable in various contexts, it was decided that the developed PPM should:

– close a gap, as to date no concise overview of KSCs, activities and tasks related to the use of FRP in construction exists,
– apply a learning outcomes approach, so that it can be used as basis for designing curricula,
– be aligned as closely as possible to the needs of the construction industry, by identifying real work processes related to the use of composites in construction,
– serve as bridge between the educational world and the world of the labour market, by providing a common language,
– have the form of a map, so that it ensures good comprehensibility and easy access to knowledge, skills and competences related to FRP in construction,
– apply a cross-national perspective, so that it can

easily be transferred to other national contexts,
– cover two professions in particular (architect and civil engineer) in order to include both KSC needed in the planning phase of buildings and in the construction phase.

To define the PPM, mostly qualitative and explorative methods were used. The content of the map was based on evidence, through company visits and interviews. Stakeholders were involved in interview, company visits and consultations. To make the map sustainable, not only the status quo of skills development was taken into account, but future trends were questioned, too.

Institutions from five countries (Poland, Spain, Austria, Slovenia and Greece) participated in the described project. Among them were higher education institutions, research institutes and sectoral business associations at local and national levels.

As a result of the interviews carried out with the professionals in Poland, Greece, Slovenia and Spain, the following work areas and activities were identified (Table 1).

On the basis of the interview results, it was possible to derive a very first rough draft of the 'main work areas' of construction workers and architects/civil engineers when it comes to the use of FRP materials. These main work areas contain "sub-work-areas" or "tasks" which are described with the most important work activities and/or tools that are necessary for fulfilling the tasks.

An example of the overview of KSC of architects and civil engineers in Poland, in the work with FRP in construction, is presented in Table 2.

In the context of task evaluated Intellectual Output, the national results and basic maps were merged into one TAB4BUILDING Professional Profile Map. This Profile Map was then forwarded to all partners for reviewing and validation on country level.

Table 3 shows the Professional Profile Map when it comes to the use of FRP materials and elements in the construction sector in Greece, Spain, Poland, and Slovenia. The left column shows eight main work areas identified in dealing with FRP in the construction sector. The next column to the right shows which of the two target groups (construction workers or architects/civil engineers) this work area concerns. This is followed by sub-categories for the respective main work areas, the "Sub-Work Areas". In the case of Work Area 1, there are four sub-work areas, three of which are important for both target groups, the last one only for architects/civil engineers. To the right of the sub-work-areas follow the respective Competence Steps' or steps of competence development. These always move from left to right from beginner to expert level and can contain a different number of competence steps in each category (usually between 1 and 6). In Work Area 3 ("Plan and design the application of FRP materials/elements"), for example, there are three competence steps in Sub-Work Area 3.1 ("Design construction elements with FRP") that is to design construction elements with FRP materials/elements under supervision, to design independently or to supervise the design as an expert.

Table 1.
Work areas and activities of architects/civil engineers in the context of FRP in construction

Country	Work area	Main work activities in the work area
PL	**Expertise of structures requiring repairs**	• interview with the user • examination of documentation • determination of the scope of inventory and research • static and strength analysis • selection of strengthening areas
PL	**Production of composite reinforcement**	• knowledge of composite quality assessment criteria • use of pultrusion devices • bending of composite rebar • quality assessment
PL	**Development of production technology**	• organizing of production process considering the specificity of the FRP material • mould making • strength and quality tests
PL	**Strengthening of bridges, strengthening of concrete structures**	• testing the properties of the substrate • selecting the appropriate adhesive • preparing the substrate and strengthening elements • selecting the proportions (mixing) • hardening the resin (cross-linking time) • maintaining cleanliness
PL	**Design of FRP reinforcements**	• static analysis • selection of the reinforcement system • design, drawing
PL	**The use of composites for concrete reinforcement (Combridge, Floors, Tram base, wall cladding**	• optimization of design solutions • numerical modelling • strength analysis • preparation of optional design • on-site training
PL	**Design and prototyping**	• research on material properties • modes of destruction • FEM modelling
PL	**Strengthening of masonry structures**	• ensuring diffusivity (determination of thermal and humidity conditions) • selecting the appropriate adhesive • preparing the substrate and strengthening elements • specificity for the substrate and the adhesive
PL	**Repair of structural damage**	• securing the construction site • supervision of preparatory works • ensuring safety conditions • supervision of works
PL	**Applications in geosynthetics (geosynthetics, embankment reinforcement, diaphragm walls)**	• optimization of design solutions • strength analysis • on-site training • monitoring (optical fibres)
PL	**Supervision of the execution**	• training the contractor • control of compliance with the design • extending the technical knowledge
PL	**Strengthening of timber structures**	• selecting the appropriate adhesive • preparing the substrate and strengthening elements • specificity for the substrate and the adhesive • fire resistance
PL	**Adaptation of the used facilities to new conditions of use**	• examination of documentation • static and strength analysis • selection of strengthening areas

Table 2. Work areas, activities, skills, requirements, competences of architects/civil engineers in the context of FRP in construction (Poland) [6]

						Competence steps		
Work Area	Sub-Work-Area	Most import workactivities	Tools/methods for fulfilling the activity	Used technology (machines, computers, ICT)	Requirements for skilled work (laws, regulations, manufacturers' concepts)	Beginner	Under Supervision	Expert
A	Expertise of structures requiring repairs	A1) interview with the user, A2) examination of documentation, A3) determination of the scope of inventory and research, A4) static and strength analysis, A5) selection of strengthening areas	A1 – keeping notes, interview report A2 – review of existing documents, if available electronic files A3 – dimensional and material inventory to the extent necessary A4 – static and strength analysis of the structure to the extent necessary, taking into account its current technical condition A5 – analysis of the results of the strength analyses	A2 – copier, camera, in case of electronic documentation computer with appropriate software (e.g. pdf reader) A3 – measures, laser rangefinders, geodesy, space scanners, NDT testing of concrete, core probes, pull-out, chemical testing of concrete (chlorides, sulphates, nitrates, nitrites) A4, A5 – computer with installed software for static and strength analyses	A2 – ability to read construction documentation A3 – ability to use measuring devices, knowledge on NDT testing of concrete A4, A5 – ability to use computer software for static and strength analyses, chartered structural engineer			Interview with the user, examination of documentation, determination of the scope of inventory and research, static and strength analysis, selection of strengthening areas
B	Design of FRP reinforcements	B1 - static analysis, B2 - selection of the reinforcement system, B3 - design, drawing	B1 – static and strength analysis of the structure including FRP reinforcement /strengthening system, B2 – matching the FRP strengthening system to the type of structure, B3 – preparation of technical drawings	B1 – computer with installed software for static analyses B2 – computer with installed software delivered by manufacturers of FRP systems, B3 – computer with installed CAD software	B1 – ability to use computer software for static analyses, B2 – knowledge about FRP strengthening technologies and their limitations, B3 – ability to use CAD software		Static analysis, design, drawing	Selection of the reinforcement system
C	Repair of structural damage	C1 – securing the construction site, C2 – supervision of preparatory works, C3 – ensuring safety conditions, C4 – supervision of works	C1 – securing the construction site, preparatory works, scaffolding, C2 – supervision of following works: cleaning the application site, impregnation, levelling the surface C3 – supervision over compliance with safety requirements C4 – supervision of assembly performed in accordance with the technology of the manufacturer of the FRP reinforcement system, protection during the setting of the adhesive	C1 – assembly of scaffolding C2 – power tools, hand tools, sandblasting, water blasting, abrasion, grinding shotcreting, mixers C4 – controlling technological regime (humidity and temperature measures), scales, mixers, strengthening press	C1 – license for scaffoldings C2 –specifications delivered by the manufacturer of FRP system C3 – chartered engineer C4 – specifications delivered by the manufacturer of FRP system		Supervision of preparatory works, supervision of works conditions,	Securing the construction site, ensuring safety,

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D	Adaptation of the used facilities to new conditions of use	D1 – examination of documentation, D2 – static and strength analysis, D3 – selection of strengthening areas	D1 – review of existing documents, if available electronic files D2 – static and strength analysis of the structure adapted to the specifics and requirements (e.g. conservation of monuments)	D1 – copier, camera, in case of electronic documentation computer with appropriate software D2, D3 – computer with installed appropriate software	D1 – historical knowledge on construction facilities D2 – ability to use computer software for static and strength analyses, chartered structural engineer D3 – knowledge about FRP strengthening technologies and their limitations		Static and strength analysis	Examination of documentation, selection of strengthening areas
A	Production of composite reinforcement	A1 – knowledge of composite quality assessment criteria, A2 – use of pultrusion devices, A3 – bending of composite rebar, A4 – quality assessment	A1 – the use of international standards to assess the quality of FRP products (type of fibre, resin, tensile strength, young modulus, chemical stability – best are American and Canadian regulations) A2 – pultrusion of glass fibre rebars A3 – Teflon moulds A4 – testing the mechanical properties and chemical resistance of composites	A1 – laboratory tests - bar weighing, strength tests, chemical durability A2 – manufacturing of FRP profiles in the pultrusion process, used automated production line, curing oven furnace, cooling devices A3 – curing oven furnace, cooling devices A4 – laboratory press, electronic scale	A1 – in Poland, there are no clear criteria to assess the quality of a composite bar A2 – ability to handling and service of pultrusion devices, knowledge about dosing of fibre rowing according to required rebar diameter, choice of appropriate hardening and cooling temperature and technology A3 – knowledge about choice of appropriate hardening and cooling temperature and technology A4 – knowledge in the scope of technical approvals of the products (diameter, grammage, rib spacing and height)		Use of pultrusion devices, bending of composite rebar, quality assessment	Knowledge of composite quality assessment criteria
B	The use of composites for concrete reinforcement (Combridge, Floors, Tram base, wall cladding)	B1 – optimisation of design solutions, B2 – numerical modelling, B3 – strength analysis, B4 – preparation of optional design, B5 – on-site training	B1-B3 – numerical modelling based of FEM B4 – preparation of structural drawings B5 – training on how to cut, how to unwind, what are the safety rules	B1-B3 – computer with installed software for structural FEM analyses B4 – computer with installed CAD software B5 – on-site employee training	B4 – Chartered engineer certified in the area of structural designing B5 – Representative of the manufacturer			Optimization of design solutions, numerical modelling, strength analysis, preparation of optional design, on-site training

C	Applications in geosynthetics (geosynthetics, embankment reinforcement, diaphragm walls)	C1 – optimization of design solutions, C2 – strength analysis, C3 – on-site training, C4 – monitoring (optical fibres)	C1 – Foundations for tram tracks without sand bedding, strengthening of embankments over piles C3 – Training on how to cut, how to unwind, what are the safety rules C4 – Fiber Bragg grating sensors embedded in the composite rebar	C1-C2 – computer with installed software for structural FEM analyses and CAD software C3 – on-site employee training C4 – Fiber Bragg grating sensors embedded in the composite rebar, optical interrogator	C2 – Chartered engineer certified in the area of structural designing C3 – Representative of the manufacturer C4 – Ability to use optical Fiber Bragg measurement systems			Optimization of design solutions, strength analysis, on-site training, monitoring (optical fibres)
A	Development of production technology	A1 – organizing of production process taking into account the specificity of the FRP material, A2 – mould making, A3 – strength and quality tests	A1 – power tools, hand tools, vacuum, scissors, brush, roller, fabric dispenser A2 – shaping three-dimensional moulds (in practice, in Poland, moulds are usually ordered from specialized manufacturers) A3 – testing material properties, quality check	A1 – adjusting the production process to material properties (types and characteristics of resins, fibre processing, types of fabrics, shape) A2 – modelling method, CNC machines (mills, lathers, cutters) A3 – laboratory press	A1 – experience in the production of composites - may be related to other industries, e.g. the yachting manufacture A2 – ability to use CNC machines A3- knowledge of material properties of FRP composites		Production process, mould making	Organizing of production process taking into account the specificity of the FRP material, strength and quality tests
B	Design and prototyping	B1 – research on material properties, B2 – modes of destruction, B3 – FEM modelling,	B1 – testing material properties, B2, B3 – numerical calculations, use of advanced material models (orthogonal, non-linear)	B1 – laboratory press (universal testing instrumentation) B2, B3 – computer with installed FEM software (mechanical analyses)	B1 – knowledge about composites and their properties (orthogonal), failure characteristic B2 – it is important to know the design process B3 – ability to use FEM software, ability to interpret the results (currently there is no standardization regarding the shape of the elements, no specialized software)			Research on material properties, modes of destruction, FEM modelling
C	Supervision of the execution	C1 – training the contractor, C2 – control of compliance with the design, C3 – extending the technical knowledge	C1 – on-site training – including material properties, procedure (e.g. you cannot drill) C2 – on-site quality control, acceptance of replacement materials C3 – cooperation with designers, contractors, presentation of research results and the latest knowledge, the specificity of technical knowledge in the field of frp composites		C1 – knowledge about the properties of FRP composites and the procedure C2 – manufacturer recommendations, reading the project C3 – knowledge about the properties of FRP composites, manufacturer requirements		Control of compliance with the design	Training the contractor, extending the technical knowledge

						Competence steps		
Work Area	Sub-Work-Area	Most import workactivities	Tools/methods for fulfilling the activity	Used technology (machines, computers, ICT)	Requirements for skilled work (laws, regulations, manufacturers' concepts)	Beginner	Under Supervision	Expert
A	Strengthening of bridges, strengthening of concrete structures	A1 – testing the properties of the substrate, A2 – selecting the appropriate adhesive, A3 – preparing the substrate and strengthening elements, A4 – selecting the proportions (mixing), A5 – hardening the resin (cross-linking time), A6 – maintaining cleanliness	A1 – visual inspection, NDT testing of concrete substrate, hammer, grinder A2 – determining the properties of the substrate and matching the appropriate adhesive A3 – bush hammering, sand blasting, grinding, brushing A4, A5 – scales, mixers, important protection against skin contact with the resin A6 – securing the place of application (covers)	A1 – pull-out A3 – mechanical cleaning, chemical cleaning A4, A5 – mixing ingredients in the right proportions	A1 – knowledge of material properties and construction testing A2 – recommendations of adhesive manufacturers, generally competence of designer A3 – recommendations of the manufacturers of FRP systems A4, A5 – instructions of the manufacturers of FRP systems	Maintaining cleanliness	Preparing the substrate and strengthening elements, selecting the proportions (mixing), hardening the resin (cross-linking time),	Testing the properties of the substrate, selecting the appropriate adhesive
B	Strengthening of masonry structures	B1 – ensuring diffusivity (determination of thermal and humidity conditions), B2 – selecting the appropriate adhesive, B3 – preparing the substrate and strengthening elements, B4 – specificity for the substrate and the adhesive	B1, B2 – strengthening based on mineral adhesives (FRCM), analysis of diffusivity conditions B3 – grinding, brushing B4 – hand tools, power tools	B1 – determination of heat and humidity conditions (of particular importance for vaults) B2 – matching the type of adhesive to the substrate B3 – mechanical cleaning, chemical cleaning B4 – grovving the masonry joints	B1 – enclosing moisture in the vault may worsen its technical condition B2 – use of FRCM systems, competence of designer B3 – recommendations of the manufacturers of strengthening systems		preparing the substrate and strengthening elements, specificity for the substrate and the adhesive	ensuring diffusivity (determination of thermal and humidity conditions), selecting the appropriate adhesive
C	Strengthening of timber structures	C1 – selecting the appropriate adhesive, C2 – preparing the substrate and strengthening elements, C3 – specificity for the substrate and the adhesive C4 – fire resistance	C1 – determining the properties of the substrate and matching the appropriate adhesive C2 – grinding, removing free parts C4 – external covering, power tools	C2 – mechanical cleaning, chemical cleaning C4 – NSM strengthening systems (Near Surface Mounted)	C1 – recommendations of adhesive manufacturers – adhesive viscosity, generally competence of designer C2, C3 – recommendations of the manufacturers of FRP systems, adhesive matched to the mechanical properties of the timber C4 – recommendation of the producer of FRP system		Preparing the substrate and strengthening elements, specificity for the substrate and the adhesive	Selecting the appropriate adhesive, fire resistance

Table 3.
Cross-national Professional Profile Map (for all project partner countries – EL, ES, PL, SI) [6]

Professional Profile Map on the use of FRP for Construction Workers and Architects/Civil Engineers					
Work Area	Target group	Sub-Work-Area	Competence Steps		
	C (Construction Worker) A (Architect/ Civil Engineer) Worker)		1 / Beginner	2 / Under Supervision	3 / Expert
1. Understand and specify FRP materials	C + A	1.1. General understanding of FRP in the construction sector	1.1.a Have basic knowledge about FRP products in the construction sector (e.g., general overview of products).	1.1.b Have good knowledge about FRP products in the construction sector (e.g., how FRP products are produced).	1.1.c Have expert knowledge about FRP products in the construction sector (e.g., criteria for their selection).
	C + A	1.2 Knowledge of different manufacturing processes of FRP products for the construction sector	1.2.a Have basic knowledge of the manufacturing processes of FRP products (e.g., knowing general processes, hand lay-up, infusion, pultrusion, RTM, vacuum bag etc.).	1.2.b Have good knowledge of manufacturing processes of FRP products (e.g. basic steps of the general process of FRP products).	1.2.c Have expert knowledge of manufacturing processes of FRP products (e.g. apply and make infusion, hand lay-up and vacuum bag…).
	C + A	1.3. Specification of FRP types and materials	1.3.a Have basic knowledge about different FRP materials (e.g., basic limitations, constraints and use conditions).	1.3.b Have good knowledge about different kinds of FRP materials (e.g., good knowledge about limitations, constraints and use condition, different kinds of resins, fibres and fungibles needed for obtaining composites).	1.3.c Have expert knowledge about different kinds of FRP materials (e.g., expert knowledge about limitations, constraints and use conditions)
	A	1.4. Search for and acquisition of FRP products	1.4.a Search for and order FRP materials/elements under supervision (e.g. basic search criteria with the main material search engines).	1.4.b Search for and order FRP materials/elements independently (e.g. first steps to select materials or products by properties, etc.).	1.4.c Supervise the searching and ordering of FRP materials/elements (e.g. supervising, purchase knowledge on the selection of the best options for products and materials).
2. Apply FRP materials	A	2.1 Read and understand technical FRP sheets	2.1.a Understand technical drawings on the use of FRP materials/elements (e.g., …).	2.1.b Compare technical data sheets.	2.1.c Modify/adapt technical drawings and the use of FRP materials/elements according to circumstances for specifications in the construction work.
	C + A	2.2 Apply FRP materials/elements in the daily work process (e.g., facades, bridges, floors)	2.2.a Apply FRP materials/elements and work tools for basic products (e.g., pipes, anchors…).	2.2.b Apply FRP materials/elements and work tools for medium level products (e.g., pools, pultrusion products).	2.2.c Apply FRP materials/elements and work tools for high level products (e.g., structures, beams, columns, bridges.).
3. Plan and design the application of FRP materials/ elements	A	3.1 Design construction elements with FRP	3.1.a Design construction elements with FRP under supervision (e.g., by using computer software …).	3.1.b Design construction elements with FRP independently.	3.1.c Supervise the design of construction elements with FRP (e.g. …).
	A	3.2 Plan and calculate the use of FRP materials/elements	3.2.a Plan and calculate the application of FRP materials/elements under supervision (e.g., …).	3.2.b Plan and calculate the application of FRP materials/elements independently.	3.2.c Supervise the planning and calculation of the application of FRP materials/elements (e.g., …).

Professional Profile Map on the use of FRP for Construction Workers and Architects/Civil Engineers					
Work Area	Target group	Sub-Work-Area	Competence Steps		
	C (Construction Worker) A (Architect/ Civil Engineer) Worker)		1 / Beginner	2 / Under Supervision	3 / Expert
4. Handling of used FRP materials/ elements	C + A	4.1 Assemble FRP materials/elements	4.1.a Have basic skills for assembling FRP materials/elements (e.g., …).	4.1.b. Have intermediate and supervision skills for assembling FRP materials/elements (e.g., …).	4.1.c. Select and design for assembling FRP materials/elements (e.g., …).
	C + A	4.2 Repair of damaged FRP materials/elements and structural damage	4.2.a. Execute steps of repairing damaged FRP materials/elements (e.g., …).	4.2.b. Supervise the repairing of damaged FRP materials/elements (e.g., …).	4.2.c. Design and select criteria for repairing damaged FRP materials/elements (e.g., …).
5. Quality Assurance	C + A	5.1 Control FRP materials/elements	5.1.a Do a basic check of received FRP materials/elements in a building process (e.g., …).	5.1.b Supervise the inspection of the quality of FRP materials/elements and take decisions (e.g., …).	
6. Work Safety and (legal) requirements	C + A	6.1 Application of all safety regulations/requirements when working with FRP materials/elements	6.1.a Apply and follow all safety regulations/requirements when working with FRP (e.g., …).	6.1.b Supervise the application of all safety regulations/ requirements when working with FRP (e.g., …)	
7.Environmental factors and the Circular Economy	C + A	7.1 Application of environmental requirements/regulations when using and designing FRP materials/elements	7.1.a Apply all environmental requirements/regulations when using FRP materials/elements under supervision (e.g., …).	7.1.b Design and supervise the application of all environmental requirements/regulations when using FRP materials/elements (e.g., …).	
	A	7.2 Application of environmental requirements/regulations for the design of construction elements with FRP	7.2.a. Apply all environmental requirements/regulations for the design of construction elements with FRP under supervision (e.g., …).	7.2.c Supervise the application of all environmental requirements/regulations for the design of construction elements with FRP (e.g., …).	
8. Documentation of data and work processes	C + A	8.1 Documentation of data and work processes	8.1.a Document all data and work processes (e.g., …).	8.1.b Supervise all data and work processes.	8.1.c Define the documentation of all data and work processes (e.g., …).

4. CONCLUSIONS

Summarising, the Professional Profile Map serves as a bridge between education and the professional world, ensuring that educational programs are relevant, effective, and responsive to the needs of the job market and industries. It helps educational institutions produce well-prepared graduates and contributes to the overall quality and effectiveness of vocational and professional education.

The integration of the Professional Profile Map (PPM) into architecture and civil engineering education through Erasmus+ project represents a significant advancement in the field. By aligning education with industry demands, customizing curricula, emphasizing sustainability, promoting interdisciplinary collaboration, enhancing practical experience, and improving employability, the PPM ensures that civil engineering graduates are not only academically proficient but also well-prepared to meet the challenges and opportunities of the evolving profession. Erasmus+ projects have played a pivotal role in fostering collaboration and innovation in higher education, and their impact on architecture and civil engineering education serves as a testament to the program's ability to drive positive change in the field. As these two disciplines continue to evolve, the PPM, with its adaptability and responsiveness, remains a powerful tool for educators and institutions committed to excellence in professional education.

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