WP4. “Training path design”

Slovene scenario for national training offer

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1 – Document synopsis

This document represents the final step in WP4 "*Training path design*" whose main objectives are to know the training offer in each country and its adaptation to "new skills" demanded by the industrialised construction systems in line with the principles and objectives of EE&CE, to analyse common and differential characteristics of these offers to fill competence gaps (EQF levels 3-4-5) and to design a common framework for the training path and determine the elements to be included: contents, methodology, assessment, resources, trainer profile and so on.

More in details, purpose of this document is the development of a training path, validated and established with European criteria to ensure a successful implementation for workers skilling and re-skilling, a referenced planning of training actions (VET centres, trainers), and an adaptation to training needs of the offsite area. This scenario for a new training offer has been built upon the major findings from the analysis of the training offer in each country and its adaptation to the "new skills" demanded by the industrialised construction systems in line with the principles and objectives of EE&CE. The analysis has been conducted as a desk research and is addressed mainly to experts and skills-based performance appraisers, VET trainers in the construction sector and experts in design of training actions in the construction industry. It started from the major findings of WP3 - "New Skills" Map elaboration by identifying the most relevant skills linked to the 4 targeted occupation: 1) Electrical installer, 2) HVAC engineering technician, 3) Roof labourer and 4) Building construction labourer. The desk research has been implemented using the most relevant sources available in the country and the most updated researches on the field, then has been sent to the selected experts via email as a basis for the feedbacks' interview. Purpose of the interviews has been the validation of key findings of the desk research and to complete any missing information on the current training offer in order to fill the identified skills gap.

Then the <u>Analysis of the national training offer</u> has been the target of a series of experts' interviews with the purpose of validating the key findings of the desk research and/or completing any missing information on the current training offer to fill the identified skills gap. Thus, all the feedback and inputs emerged from the interviews have been processed and integrated with the current training offer to create the new scenario.

Lastly, the same scenario has been validated via an online questionnaire administered to a series of relevant stakeholders and experts whose major findings are reported on Chapter 4.

2 – Major findings from the Analysis of the national training offer

In professions traditionally associated with construction (construction workers and roofer/carpenters), the content described in professions associated with industrialized construction is not particularly emphasised. This may be because this type of construction is not yet very common in Slovenia, although in the past after 2WW many residential neighbourhoods were built in this way (outline in the initial SI status quo report). There also has been so far no suggestion from the business sector (employers) that training programmes should be adapted to include those contents.

When looking at the different training options for personnel that could be working in the field of industrialised construction, two types of education and training courses can be identified.

Personnel can be trained and educated in formal vocational training programmes, which is most evident in the case of personnel in the electrical installation sector. In linking the competences described for the electrical installers, we have reviewed the existing vocational education and training programmes at different levels and described the modules that make up the training programmes and correspond to the competences. These modules stand out in terms of their duration and are not delivered in isolation.

Formal educational programmes for HVAC technicians also cover topics related to the installation of heat pumps. Additionally, it is possible to join a specialized training programme in the field of smart installations. In the area of mechanical installations, there are also legally mandated training sessions that are regularly conducted and are a prerequisite for performing these activities.

The second set of training courses on Slovenian market consists of content that is prescribed and compulsory in various ways for the personnel carrying out the work, for example in the work teams of producers of these elements and objects. These programmes are shorter, and in some cases the content and duration of the programmes are not publicly available and sometimes agreed with bilateral contract-producer and contractor. From the report on the national training offer we can see that the most common are short programmes in the field of health and safety procedures which are also compulsory for personnel working in construction.

In most cases, however, it can be seen that specialised apart from themes such industrialisation short programmes for the personnel, specifically for roof workers and construction workers in the field of BIM technology, ergonomic work practices, extreme working conditions, interpretation of digital plans, building green roofs **are not bein**g carried out in Slovenia.

The training offer in Slovenia shows gaps in the training offer to meet the demands (and to address world sectoral trends) of the construction sector, in particular in the specific context of industrialized industry, energy efficiency and the circular economy (EE&CE).

One major message from the interviews with the experts is that industrialized construction demands larger interplay of disciplines. Our challenge is how to integrate the different disciplines, because in Slovenia civil engineering is a special discipline that does not include electrical and mechanical engineering.

There would be possibility to think about a new VET programme in similar way to mechatronics - linking contents specifically needed in industrialized construction. The programme should build on competences that relate to this type of construction.

There were currently no initiatives from employers to develop short training programmes for specific content, such as recognising the impact of maintenance and demolition materials for construction workers, indicating a gap in training in life cycle analysis and sustainable management of materials, green roofs, preparation of photovoltaic walls, interpretation of plans for modular construction and installation of connections for modular building elements for construction. Perhaps severe and extreme climate events will change the nature of construction in the future to provide a quick property to live in for those whose homes are damaged and in need of shelter, as such construction is faster, can unified and approved by the state as viable technical solution.

In conclusion, we can state that Slovenia has a strong vocational and professional education system, which is still recognised by the industry as the primary option for acquiring professionally trained personnel. According to the analysis of educational programmes in the fields of electrical engineering and mechanical installations, Slovenia offers programmes that already cover a significant portion of the competencies required for personnel working in the field of industrialised construction. However, these programmes incorporate less knowledge related to the use of BIM technology, which likely reflects the current state of adoption within the industry itself.

In educational programmes related to construction, there is a greater discrepancy between the content currently emphasised in the curricula and the requirements brought by sustainable, green construction, as well as the digitisation of the sector.

Industrialised construction in Slovenia does not yet represent a strong enough sector to demonstrate a need for new educational programmes, or even for short programmes tailored to its specific needs. In focus group, company representatives highlighted that they require personnel with fundamental professional knowledge, while all additional specialised skills and expertise are acquired within the company itself.

3 – The Slovenian scenario for a new training offer

The scope of this activity is to design a common framework for the training path and determine the elements to be included starting from the existing courses mapped in task 4.1. A series of experts' interviews[1] has been conducted with the purpose of validating the key findings of the desk research and/or completing any missing information on the current training offer to fill the identified skills gap, and the following tables are thus exploiting the experts' view on the new scenario right to be integrated with the current offer.

Title of the course *<Unit of competence>*	**Roofer / construction labourer** **Use of digital technology in construction operational work** **(module in VET programme)** **(4 EQF Level)**
Expected results	Develop skills in reading and interpreting 2D and 3D digital plans and using BIM technology for planning own work and monitoring the work process and use of materials.
Indicators	▪ Use of digital tools in the planning of construction works ▪ use design software. ▪ prepare project construction schedule with the help of IT tools. ▪ use IT gadgets at the construction site
Capacity	▪ reading and interpreting project design, sketches, signs for construction project.

[1] At least 3 different experts have been interviewed in each country.

	▪ use PDF and PDF/A programmes during their work.
Knowledge	▪ having knowledge and proper use of one of the available software for construction scheduling, is able to explain the investor a schedule and some of its details, be able to correct the construction schedule directly on the terrain work (construction site, renovation space etc.) ▪ understanding building sequence and related construction schedule and its structure and time and financial consequences of delays of specific group work

Title of the course *<Unit of competence>*	Life cycle analysis and sustainable management of materials **(module in VET programmes Roofer and Construction labourer)** **(4 EQF Level)**
Expected results	Development of skills for monitoring material consumption in construction and demolition works. This should include consideration of the lifespan of installed materials, their impact on the building's carbon footprint, and possibilities for reuse.
Indicators	▪ **Understanding LCA** enables workers to make informed choices, such as selecting locally-sourced materials that have less transportation impact.

	▪ **Handling and installing materials carefully** helps prevent damage and waste, saving resources. ▪ **Waste management skills** ensure that reusable and recyclable materials are separated on-site, keeping construction sustainable. ▪ **Green building standards knowledge** helps construction workers follow specific project guidelines that aim to reduce the overall environmental footprint of the building.
Capacity	• Implementing on-site waste management strategies, including sorting, reusing, and recycling construction debris • Properly handling, storing, and installing sustainable materials to avoid waste and damage. • salvaging materials from demolished structures for reuse in new builds or recycling elements like metal, concrete, and glass.
Knowledge	• familiarity with how materials impact the environment over their entire life cycle (from extraction to disposal). • Understanding the basics of LCA, such as energy use, carbon footprint, and waste generation of materials. • Knowledge of sustainable sourcing practices to handle certified or responsibly sourced materials. • Recognizing ways to reduce the energy consumption associated with transporting, handling, and using materials.

Title of the course *<Unit of competence>*	Green roofs installation **(module in VET programmes Roofer and Construction labourer** **(4 EQF Level)**
Expected results	Building **green roofs**—also known as living roofs—requires specialized skills to ensure successful installation and sustainability. Green roofs provide environmental benefits like improved insulation, stormwater management, and increased biodiversity. Effective installation and maintaining of green roofs, contributing to sustainable, energy-efficient, and environmentally-friendly buildings.
Indicators	▪ **Waterproofing and root barriers** are critical for protecting the building, while the **drainage and irrigation systems** manage water flow and support plant health. ▪ **Structural assessment** and **edge protection** ensure the roof can safely support the green roof's weight and withstand environmental conditions. ▪ **Plant selection** and **soil application** directly influence the roof's aesthetic appeal and environmental benefits, such as cooling and habitat creation.
Capacity	• Assessment of the structural integrity of the building to support the additional weight of a green roof system. • Installation of high-quality waterproofing membranes such as PVC or EPDM over the roof deck to create a barrier that protects the building from moisture infiltration. • Laying a proper drainage layer that allows excess water to drain off while retaining enough moisture for plant growth.

	• Installing a root barrier to prevent plant roots from penetrating the waterproof membrane or damaging the roof structure. • Applying the correct type of growing medium (substrate) tailored to the vegetation type while ensuring it's lightweight and nutrient-rich. • Choosing appropriate plant species suited to the local climate and the specific environmental conditions of the roof. • Installing efficient irrigation systems, such as drip irrigation or rainwater harvesting systems, to maintain plant health. • Adding an insulation layer that enhances the building's thermal performance, helping regulate indoor temperatures.Installing edge restraints and wind barriers to secure the green roof system and prevent it from being damaged by strong winds.
Knowledge	• Load-bearing capacities to confirm whether the existing roof can handle the weight of soil, vegetation, and water, or if structural reinforcements are needed. • Drainage systems and materials used to channel the water away from the roof and root – resistant barriers • Soil and growing mediums designed for green roofs that support plants' growth without adding excessive weight. • Difference between extensive, semi intensive and intensive green roofs and when it is appropriate to install them.

Title of the course	PC walls installation **(module in VET programme Electrician)**

<Unit of competence>	**(4 EQF Level)**
Expected results	The installation of **Photovoltaic (PV) walls**—which incorporate solar panels into the vertical surfaces of buildings—requires a combination of construction, electrical, and safety skills. Effective installation of PV walls that not only generate renewable energy but also enhance the building's energy efficiency, contributing to a more sustainable and eco-friendly structure.
Indicators	▪ **Structural and electrical assessments** ensure that the PV system integrates safely with the building and power grid. ▪ **Mounting systems, wiring, and panel installation** involve detailed work to securely and effectively install the PV components. ▪ **Weatherproofing and safety protocols** protect both the workers and the building from damage or hazards during and after installation.
Capacity	• Evaluating the building's structural integrity to ensure it can support the weight and wind loads of the PV panels. • Installing specialized mounting systems to securely attach PV panels to vertical surfaces, ensuring they can withstand environmental stresses like wind and rain • Applying waterproof membranes or sealants around mounting points, ensuring the installation does not compromise the building's weatherproofing • Positioning and securing PV panels onto the mounting system to maximize sunlight exposure.

	• Wiring the PV panels together in series or parallel, depending on the system design, and connecting them to inverters and other electrical components. • Installing the inverter and integrating it with the building's electrical system to convert the direct current (DC) generated by the PV panels into usable alternating current (AC). • Testing the installed PV system to ensure it generates electricity correctly and integrates with the building's power system without faults.
Knowledge	• Basic understanding of electrical systems, including how solar panels convert sunlight into electricity and how they connect to the building's power supply. • optimal sunlight exposure based on the building's geographic location • safety protocols related to electrical systems, fall protection (working at heights), and general construction safety.

Title of the course *<Unit of competence>*	**lBuilding information modeling** **(module in VET programme Construction engineer)** **(5 EQF Level)**
Expected results	Be able to use BIM technology in the design, construction and maintenance process of building and infrastructure works, with particular reference to the three-dimensional description, the extraction of graphic

	data and the specific technical attributes of the building or infrastructure object.
Indicators	▪ Examination and analysis of existing models and spatial study of the work. ▪ Creation and verification of the BIM model according to standards, with proprietary and open formats (IFC). ▪ Extraction of graphics and data from the BIM model for calculations and programming. ▪ Interoperability programming and continuous updating of the BIM model.
Capacity	▪ Acquire and interpret data to create BIM models of structural and infrastructural works. ▪ Adopt BIM technologies and applications, defining libraries of supporting objects. ▪ Apply extraction and virtualization techniques for project representation and management. ▪ Verify the correctness and consistency of the BIM model, using analysis and clash detection tools. ▪ Manage the archiving, integration and updating of the BIM model over time
Knowledge	▪ Materials technology and technological systems related to construction. ▪ Structural elements and building survey and tracing techniques.

	▪ Digitalization of the construction process and application of BIM tools. ▪ Main drawing techniques, BIM modeling, rendering and virtualization (VR and AR). ▪ Workplace safety regulations, management of construction site works and legislative references.

4 – The experts' validation

In the focus group discussion, we have asked the experts from industry the following questions:

1. According to your knowledge are there any other inputs to add in terms of contents, methodology, assessment, resources, trainer profile and so on?
2. And in general, what would you suggest to VET centres / trainers for possible paths to ensure a successful implementation for workers skilling and re-skilling and an adaptation to training needs of the offsite area?

Synthesis of the discussion:

In the field of modular construction, we are not familiar with any specialized training programmes, as this type of construction is not yet widely present in Slovenia. We are more familiar with the production of individual building elements, which are then incorporated into structures.

Companies that manufacture prefabricated buildings usually train their own assemblers, who put together the individual elements into a complete structure. Currently, this is part of their comprehensive service offering, and they do not show interest in transferring the training to educational institutions.

Industrialised construction in Slovenia does not yet represent a strong enough sector to demonstrate a need for new educational programmes, or even for short programmes tailored to its specific needs. In focus group, company representatives highlighted that they require personnel with fundamental professional knowledge, while all additional specialised skills and expertise are acquired within the company itself.

The proposed enhancements to educational programmes reflect developments in the construction sector, which is moving away from the traditional perception of construction professions. This shift could positively impact interest in enrolling in courses in this field. As new technologies are introduced in the sector, the societal perception of construction careers is evolving, with an increasing level of job complexity and difficulty, which in turn raises both the demands of the profession and compensation.

The representatives of the educational institution also emphasized that some of the technical skills intended to be included in the educational programs are so specific that it will be necessary to provide prior training for the teachers who will be training this workforce.

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