WP4. “Training path design”

Training paths of “new skills” in North Macedonia

Knowledge and skills management centre

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Content

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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 to support the development of a training path, validated and established based on the 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.

Then the Analysis of the national training offer 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

Industrialized construction in North Macedonia, is still in its roots and needs more intense promotion in order to enhance the uptake and in parallel, it is experiencing a transformation with the adoption of new technologies and methods aimed at increasing efficiency and sustainability. Especially for the four occupations that this study refers to, there are several skills that are becoming increasingly important.

While there is relatively descent training offer related to general skills for construction workers in North Macedonia, there is scarced offer of training opportunities available for the essential skills related to the industrialised construction. There is a notable presence of vocational training in general skills for the traditional construction, but some specialized skills, particularly those related to new technologies and sustainability practices in industrialised construction, may require further development.

Here's an overview of the current state of training offer in North Macedonia for the mentioned occupations.

2.1. Matches & gaps in the current training offer for Electrical installer

Strength: There is an extended offer for electrical engineers considering their technical proficiency, knowledge of codes and standards, troubleshooting and problem-solving, reading blueprints and schematics, technological adaptability, and safety practices. These trainings especially cover the knowledge for design and installation of solar devices.

The available training offer for the electrical installer is abundant in the nonformal VET in North Macedonia. There is a significant correspondence between the identified need of the content of training offer for the electrical installer and what is offered:

- Use BIM models
- Install smart devices
- Interpret 2D and 3D digital plans
- Calculate solar panel orientation
- Mount photovoltaic panels
- Follow health and safety procedures in construction and working at heights

This topics are significantly covered in the current training offer.

Weakness: The available training offer for the electrical installer is abundant in the nonformal VET in North Macedonia. However, these trainings mainly offer knowledge and skills for “traditional” installers. By comparing the list of required skills in the NewSkills map, the observation is that there is lack of training offer in more advanced and up-to-date skills like

- Install smart devices and automation components
- Use diagnostic tools for electronic repairs
- Assemble sensors and electrical and mechatronic components and units

On the opposite, a pleasant conclusion is that the skills related to installation of solar devices are well covered in the training offer.

2.2. Matches & gaps in the current training offer for HVAC engineering technician

Strength: There is satisfactory amount of the training offer for HVAC technicians, including the installation and maintenence of the automated systems and installation of geothermal heat pumps. What is mostly included in the training offer and the required skills that corresponds to the identified needs is

- Interpret 2D and 3D digital plans
- Install and maintain home automation systems
- Install geothermal heat pump

A specific skills for maintenance of the installed systems are also offered in specific courses beside the fact that these technologies are relatively new, and so far the highest demand was for their installation, not the maintenance.

Weakness: In the training offer for HVAC technicians, the installation of the automated systems is much more included in the training curricula. What is identified as a gap in the training offer and the required skills is:

- Lead a team perform maintenance on installed equipment
- Ensure compliance with environmental legislation

Specific green skills for environmental protection when selecting proper materials are however necessary to be added in the training content. This also refers to the eventual legislation demands for disposal of the used equipment or coolants after the end of the usage.

2.3. Matches & gaps in the current training offer for Roof labourer

Strength: The training offer for Roofers is reflecting even more the relevance of the old practices, and stressing the need for advancing the training offer, to support the new technological advancements. There is a need for enhancing the training curricula for roofers in order to be suitable for new industrialised construction. The only topics related to skills for industrialised construction are

- Interpret 2D and 3D digital plans
- Prepare the roof for solar system (PV and solar thermal system)
- Follow safety procedures when working at heights

There is a need for enhancing the training curricula for roofers in order to be suitable for new industrialised construction.

Weakness: The training offer for Roofers is reflecting even more the relevance of the old practices, and stressing the need for advancing the training offer, to support the new technological advancements. This is seen in the absence of the training offer for skills for

- Establish green roof
- Program a CNC controller

Furthermore, there is a need for introducing skills in the training offer for conservation needs, sorting waste and demolition materials and planning the construction supplies and calculating needs for construction supplies. This skills must be in the syllabus of modern construction practitioners.

2.4. Matches & gaps in the current training offer for General building labourer

Strength: The skills offered in the training offer for general building laborers are mainly related to traditional construction. There is much content non-covered in the existing training that is related to the industrialised construction. Most covered topics in the available trainings are:

- Interpret 2D and 3D digital plans
- Follow safety procedures when working at heights
- Prepare the envelope for PV walls

Weakness: Adjustment to the new ways of building is mostly needed for the general building laborers, in order to respond to the challenges for industrialised construction. The skills related to

- Interpreting plans for modular construction and
- Connection of modular elements

are most scarced, resulting with not competent workers when it comes for the industrialised construction.

Next topic also necessary to be covered in the updated training programs is

- Sorting waste and demolition materials and
- Recognizing impact of materials lifetime for maintenance and demolition, as well as
- Calculation of the needs for construction supplies

Last but not the least is the finding that skills for working ergonomically, must be added in the training offer.

2.5. General conclusion and suggestions upon expert interviews

Designing a common framework for training paths in industrialized construction in North Macedonia, is a challenging task. This implies continuous update and modernisation of the training curricula, especially with the evolution of new technologies.

The conclusions from the interviews with experts are as follows:

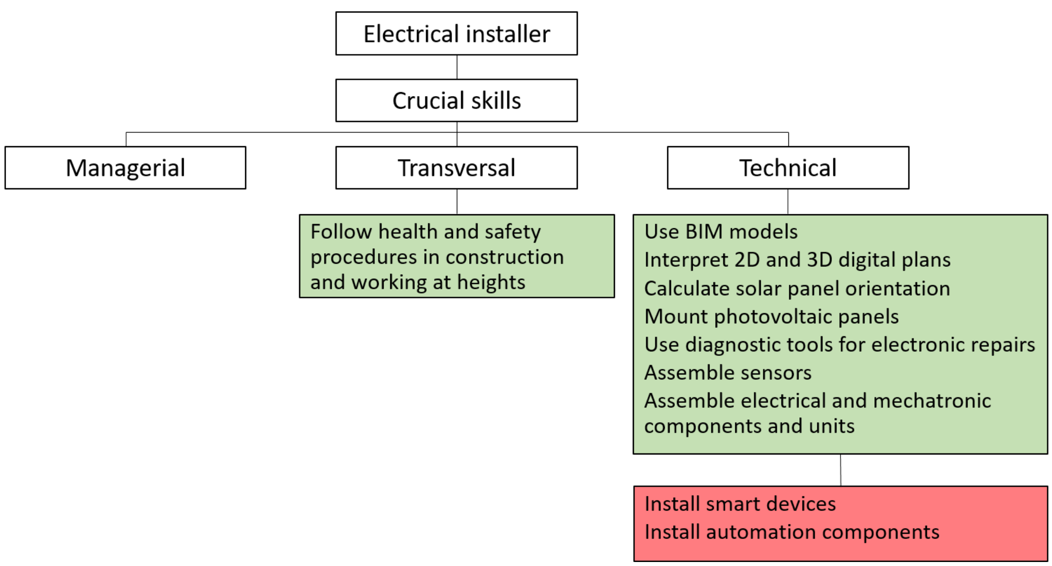
- The major discrepancies between the existing offer and the identified skills need in the skills map are related to the use of new technologies.
- The identified training offer in North Macedonia, collected during the desk research is presented realistically. The report includes the main training opportunities existing in VET. Maybe it is important to point that there are trainings offered at the work place which are not systemised and listed in the findings, but should be taken into account.
- The training courses identified with the mapping are structured according to the project's expected outcome, to propose a common framework of the training path, including all necessary elements: contents, methodology, assessment, resources, trainer profile and target groups.
- The thing that may be added are the use of novel training methods and tools like virtual reality, artificial intelligence, digital tools etc. in the training process.

3 – The Macedonian 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.

3.1. Training path scenario for Electrical installer

For the occupation of the Electrical installer there is an abundant training offer in the MK national VET formal and nonformal sector.



The selection of the most complementally training courses that would lead to achievement of a complete list of competences for electrical installer is as follows:

Title of a training course	Web link	Coverage	Share in the total training time

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

Installer of electrical installations	https://ks.org.mk/en/installer-of-electrical-installations-with-skills-for-implementation-of-energy-efficiency-measures/	• basic concepts of energy efficiency, its importance and legislation • possibilities for energy savings in buildings, especially concerning electrical installations • technology and materials for EE electrical installations • practical training for proper installation of EE electrical components, according to the quality standards and respecting the basic health and safety regulations.	60%
BIM for practitioners: engineers, architects and technicians	https://ks.org.mk/bim-za-inzheneri-arhitekti-i-tehnichari/	The curriculum of the program focuses on the development of fundamental Building Information Modeling – BIM skills for architects and engineers and problem-solving strategies to reduce the gap between designed and actual energy performance of buidings.	10%
Installer of RES	https://cov.gov.mk/course/%d0%b8%d0%bd%d1%81%d1%82%d0%b0%d0%bb%d0%b0%d1%82%d0%b5%d1%80-%d0%bd%d0%b0-%d1%81%d0%b8%d1%81%d1%82%d0%b5%d0%bc%d0%b8-%d0%b7%d0%b0-	The content of the training program includes a detailed overview of the current knowledge of systems for the use of energy from renewable energy sources, covering current materials and techniques for their incorporation, mounting and installation, design basics, planning for the correct installation and	20%

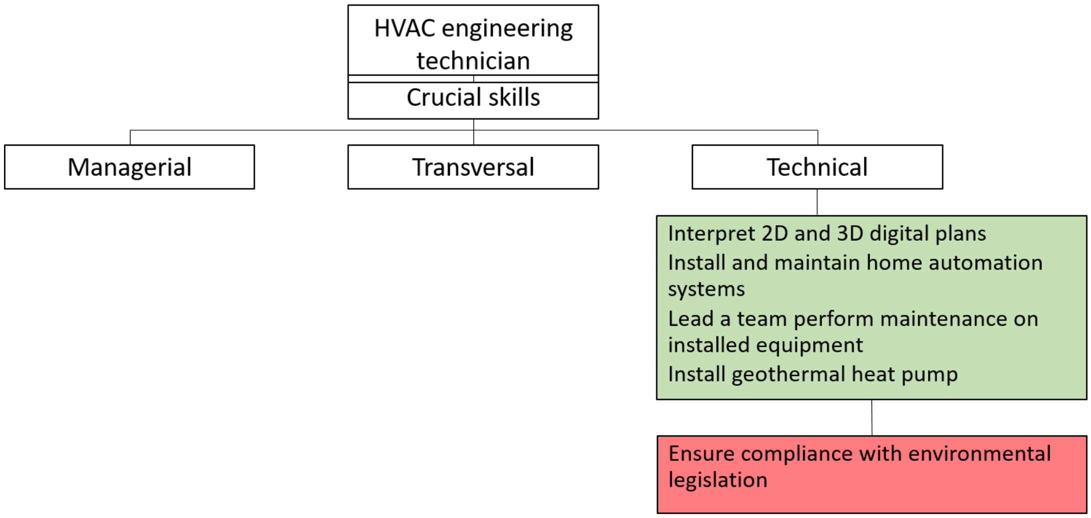
	%d0%b5%d0%bd%d0%b5%d1%80%d0%b3%d0%b8%d1%98%d0%b0-%d0%be%d0%b4-%d0%be/	maintenance of Photovoltaic systems, elements of the theoretical basis of the processes, characteristics of the components and systems and their dimensioning, as well as environmental aspects, and provides adequate familiarization with European standards, techniques for measuring energy savings, as well as procedures for protection at work.	
Install smart devices and automation components **Assemble sensors and electrical and mechatronic components and units**	NA	New elements to be included in the training course	10%

*the full content of the above mentioned trainings is given in the corresponding fact sheets in Annex 1

3.2. Training path scenario for HVAC engineering technician

There is satisfactory amount of the training offer for HVAC technicians, including the installation and maintenence of the automated systems and installation of geothermal heat pumps. A specific skills for maintenance of the installed systems are also offered in specific courses beside the fact that these technologies are relatively new, and so far the highest demand was for their installation, not the maintenance.

A specific green skills for environmental protection when selecting proper materials are however necessary to be added in the training content. This also refers to the eventual legislation demands for disposal of the used equipment or coolants after the end of the usage.



The selection of the most complementally training courses that would lead to achievement of a complete list of competences for HVAC technicians is as follows:

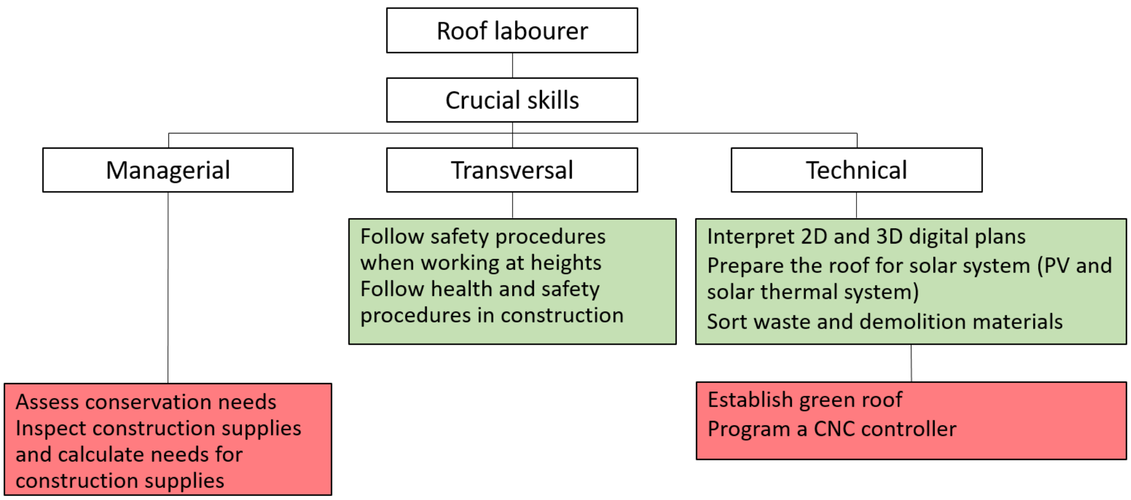
Title of a training course	Web link	Coverage	Share in the total training time
HVAC installer	https://ks.org.mk/en/installer-of-systems-for-heat-ventilation-and-air-conditioning-with-skills-for-implementation-of-energy-efficiency-measures/	• energy efficiency and renewable energy sources in building sector • an overview of the equipment, materials and systems for HVAC • practical training for installing of an equipment materials and systems for HVAC • practical training for exploitation and maintenance of equipment, materials and systems for HVAC • practical training for floor, wall and ceiling heating and aqueduct systems.	60%

Maintaining of HVAC systems	https://cov.gov.mk/course/%d1%81%d0%b5%d1%80%d0%b2%d0%b8%d1%81%d0%b5%d1%80-%d0%bd%d0%b0-%d1%81%d0%b8%d1%81%d1%82%d0%b5%d0%bc%d0%b8-%d0%b7%d0%b0-%d0%bb%d0%b0%d0%b4%d0%b5%d1%9a%d0%b5-%d0%b8-%d1%82%d0%be%d0%bf%d0%bb%d0%b8%d0%bd%d0%bd-2/	Servicing and maintenance of refrigeration and air conditioning devices that use carbon dioxide (CO2) or fluorised gases as a refrigerant	20%
BIM for practitioners: engineers, architects and technicians	https://ks.org.mk/bim-za-inzheneri-arhitekti-i-tehnichari/	The curriculum of the program focuses on the development of fundamental Building Information Modeling – BIM skills for architects and engineers and problem-solving strategies to reduce the gap between designed and actual energy performance of buidings.	10%
Ensure compliance to environmental legislation	NA	New elements to be included in the training course	10%

*the full content of the above mentioned trainings is given in the corresponding fact sheets in Annex 1

3.3. Training path scenario for Roof labourer

The training offer for Roofers is reflecting even more the relevance of the old practices, and stressing the need for advancing the training offer, to support the new technological advancements. There is a need for enhancing the training curricula for roofers in order to be suitable for new industrialised construction. Furthermore, there is a need for introducing skills in the training offer for conservation needs, sorting waste and demolition materials and planning the construction supplies and calculate needs for construction supplies. This skills must be in the syllabus of modern construction practitioners.



The selection of the most complementally training courses that would lead to achievement of a complete list of competences for roof construction worker is as follows:

Title of a training course	Web link	Coverage	Share in the total training time
Roof construction worker with skills for implementation of energy efficiency measures	https://ks.org.mk/en/roof-construction-worker-with-skills-for-implementation-of-energy-efficiency-measures/	• introduction into the most recent principles, standards and regulations regarding EE of buildings, in accordance with the national and the EU policies	60%

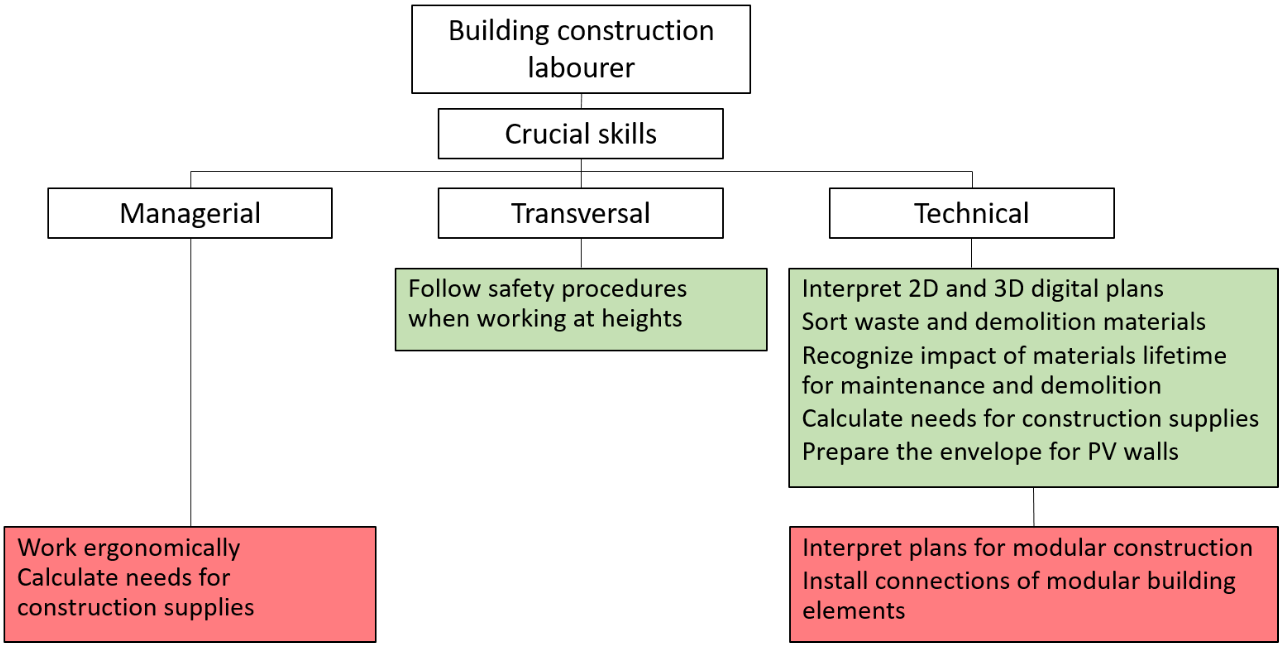
		• overview of the materials, tools and equipment, for performance of EE roofs and proper utilization • overview of the technologies and skills for construction, reconstruction, maintenance, examination and diagnostics, quality control of EE roofs • safety and health while in roof construction, management of the basic risks • practical training for proper construction of EE roofs: planning, proper layering of the components, utilization of tools and equipment as well as proper performance of the specific details.	
BIM for practitioners: engineers, architects and technicians	https://ks.org.mk/bim-za-inzheneri-arhitekti-i-tehnichari/	The curriculum of the program focuses on the development of fundamental Building Information Modeling – BIM skills for architects and engineers and problem-solving strategies to reduce the gap between designed and actual energy performance of buidings.	10%
Introduction to Sustainability in the Construction Sector	https://iege.edu.mk/education/introduction-to-sustainability-in-the-construction-sector/	This course will provide fundamental knowledge and hands-on experience for practicing sustainability in construction sector. The aim of the course is highlighting the environmental, social and economic	10%

		• Sustainability as a general concept and its importance in the construction sector • Sustainable Development Goals (SDGs) • Building and environmental legislation relevant to sustainability in construction industry • Sustainable waste management in construction • Circular Economy for a Sustainable Built Environment	
Establish green roof **Program a CNC controller** **Manage construction supplies and conservation needs**	NA	New elements to be included in the training course	20%

*the full content of the above mentioned trainings is given in the corresponding fact sheets in Annex 1

3.4. Training path scenario for General building labourer

The offered skills in the training offer for general building labourers, are mainly related to traditional construction. There is much content non covered in the existing trainings that is related to the industrialised construction. Adjustment to the new ways of building is mostly needed for the general building labourers, in order to respond to the challenges for industrialised construction.



The selection of the most complementally training courses that would lead to achievement of a complete list of competences for general building labourer is as follows:

Title of a training course	Web link	Coverage	Share in the total training time
Bricklayer	https://cov.gov.mk/course/%d1%95%d0%b8%d0%b4%d0%b0%d1%80-3/	• By successfully mastering the program, the participant will acquire theoretical knowledge and practical skills to be able to use bricks and blocks, structural tiles, stones for building paths, fences, walls, buildings and other structures, as well as to repair older buildings, monitor and work according to occupational health and safety regulations and	20%

		communicate with co-workers and supervisors.	
Façade worker	https://cov.gov.mk/course/%d1%84%d0%b0%d1%81%d0%b0%d0%b4%d0%b5%d1%80-6/	• The main goal of the program is for the participant to acquire knowledge, skills and competences for the application of the basic techniques in the construction of facade walls with the correct use of the equipment and tools for production with modern materials, to be trained in the repair of worn and damaged facades applying principles of energy efficient buildings with the application of thermal and sound insulation.	35%
BIM for practitioners: engineers, architects and technicians	https://ks.org.mk/bim-za-inzheneri-arhitekti-i-tehnichari/	The curriculum of the program focuses on the development of fundamental Building Information Modeling – BIM skills for architects and engineers and problem-solving strategies to reduce the gap between designed and actual energy performance of buidings.	10%
Introduction to Sustainability in the Construction Sector	https://iege.edu.mk/education/introduction-to-sustainability-in-the-construction-sector/	This course will provide fundamental knowledge and hands-on experience for practicing sustainability in construction sector. The aim of the course is highlighting the environmental, social and economic	10%

		• Sustainability as a general concept and its importance in the construction sector • Sustainable Development Goals (SDGs) • Building and environmental legislation relevant to sustainability in construction industry • Sustainable waste management in construction • Circular Economy for a Sustainable Built Environment	
Interpret plans for modular construction **Install connections of modular building elements** **Work ergonomically** **Calculate needs for construction suplies**	NA	New elements to be included in the training course	25%

*the full content of the above mentioned trainings is given in the corresponding fact sheets in Annex 1

4 – The experts' validation

The scope of this activity is validation of the proposed New skills map that identifies training paths for competent workforce in industrialised construction in North Macedonia. The validation was conducted with national/international external experts to ensure their value and suitability of the proposed New skills map for industrialized construction companies' requirements for skilled workforce.

The validation was conducted with an online validation questionnaire. The overall scope of the online survey was to validate the overall conclusions driven from desk research, experts' interviews and the focus groups, which led to creation of a proposal of the New skills map.

The validation respondents emphasised the importance of mapping paths of "new skills" in North Macedonia, based on the key findings from the of the project regarding industrialized building systems to bridge skills gaps between traditional occupations and upgraded qualifications for industrialized construction.

Concerning the quality criteria of the proposed paths of "new skills" of North Macedonia, the main conclusions are following:

- The overall content of the findings in document WP4. "Training path design"- Mapping paths of "new skills" of North Macedonia is presented in a logical and to the point manner.
- The mapped paths of "new skills" of North Macedonia is relevant to the existing offer of trainings concerning industrialized construction and that should be upgraded with additional qualifications for industrialized construction.
- The findings provide the basis to ensure the training path of "new skills" for industrialized construction improving energy efficiency and circular economy and can contribute to reaching higher level objectives, identifying training path of "new skills" in the industrialized systems.

The detailed results from the validation are presented in Annex 2 of this document.

Annex 1.- Factsheets of the selected training courses used as a baseline for new skills maps

Title of the course *<Unit of competence>*	**Installer of electrical installations**
Expected results	1. Basic concepts of energy efficiency, its importance and legislation 2. Possibilities for energy savings in buildings, especially concerning electrical installations 3. Technology and materials for EE electrical installations 4. Practical training for proper installation of EE electrical components, according to the quality standards and respecting the basic health and safety regulations
Indicators	
Capacity	
Knowledge	1. Familiarization with the subject, meaning and importance of energy efficiency 2. Recognition and proper choice of energy efficiency measures through usage of appropriate engines and devices, load distribution, EE lightening, systems for communication and automatic control, systems for monitoring of energy consumption 3. Knowledge of available materials, technologies and mounting procedure of EE electrical installations 4. Skills for proper installation of EE electrical installations, according to the quality standards and basic rules for health and safety

Title of the course *<Unit of competence>*	**BIM for practitioners: engineers, architects and technicians**
Expected results	The curriculum of the program focuses on the development of fundamental Building Information Modeling – BIM skills for architects and engineers and problem-solving strategies to reduce the gap between designed and actual energy performance of buidings.
Indicators	
Capacity	The content of training include: • introduction to the theory of BIM (Technology and interoperability, the role of the stakeholders, information technology and system requirements, BIM Contracts) • development of skills (Introduction to Modelling, surveying, project sample, construction management) • energy performance (Theory of energy performance, solar systems, thermal bridges).
Knowledge	

Title of the course *<Unit of competence>*	**Installer of RES**
Expected results	The content of the training program includes a detailed overview of the current knowledge of systems for the use of energy from renewable

	energy sources, covering current materials and techniques for their incorporation, mounting and installation, design basics, planning for the correct installation and maintenance of Photovoltaic systems, elements of the theoretical basis of the processes, characteristics of the components and systems and their dimensioning, as well as environmental aspects, and provides adequate familiarization with European standards, techniques for measuring energy savings, as well as procedures for protection at work.
Indicators	
Capacity	As a result of the program, qualified installers will be called for mounting and installation of energy systems from renewable energy sources, more specifically Photovoltaic systems, with solid skills, knowledge and abilities required for new occupations and knowledge of work processes at the operational level.
Knowledge	

Title of the course *<Unit of competence>*	**HVAC installer**
Expected results	Training program is dedicate to: • energy efficiency and renewable energy sources in building sector

	• an overview of the equipment, materials and systems for HVAC • practical training for installing of an equipment materials and systems for HVAC • practical training for exploitation and maintenance of equipment, materials and systems for HVAC • practical training for floor, wall and ceiling heating and aqueduct systems.
Indicators	
Capacity	
Knowledge	

Title of the course *<Unit of competence>*	**Maintainer of HVAC systems with CO2 or fluorides coolants**
Expected results	Servicing and maintenance of refrigeration and air conditioning devices that use carbon dioxide (CO2) or fluorides coolants as a refrigerant
Indicators	
Capacity	
Knowledge	

Title of the course *<Unit of competence>*	**Roof construction worker with skills for implementation of energy efficiency measures**
Expected results	This course will focus on:

	• introduction into the most recent principles, • standards and regulations regarding EE of buildings, in accordance with the national and the EU policies • overview of the materials, tools and equipment, for performance of EE roofs and proper utilization • overview of the technologies and skills for construction, reconstruction, maintenance, examination and diagnostics, quality control of EE roofs • safety and health while in roof construction, management of the basic risks
Indicators	
Capacity	Practical training for proper construction of EE roofs: planning, proper layering of the components, utilization of tools and equipment as well as proper performance of the specific details.
Knowledge	

Title of the course *<Unit of competence>*	**Introduction to Sustainability in the Construction Sector**
Expected results	This course will provide fundamental knowledge and hands-on experience for practicing sustainability in construction sector. The aim of the course is highlighting the environmental, social and economic impacts of buildings and built environment and the importance of initiatives and aspirations that will drive the transformation of the construction sector in future.

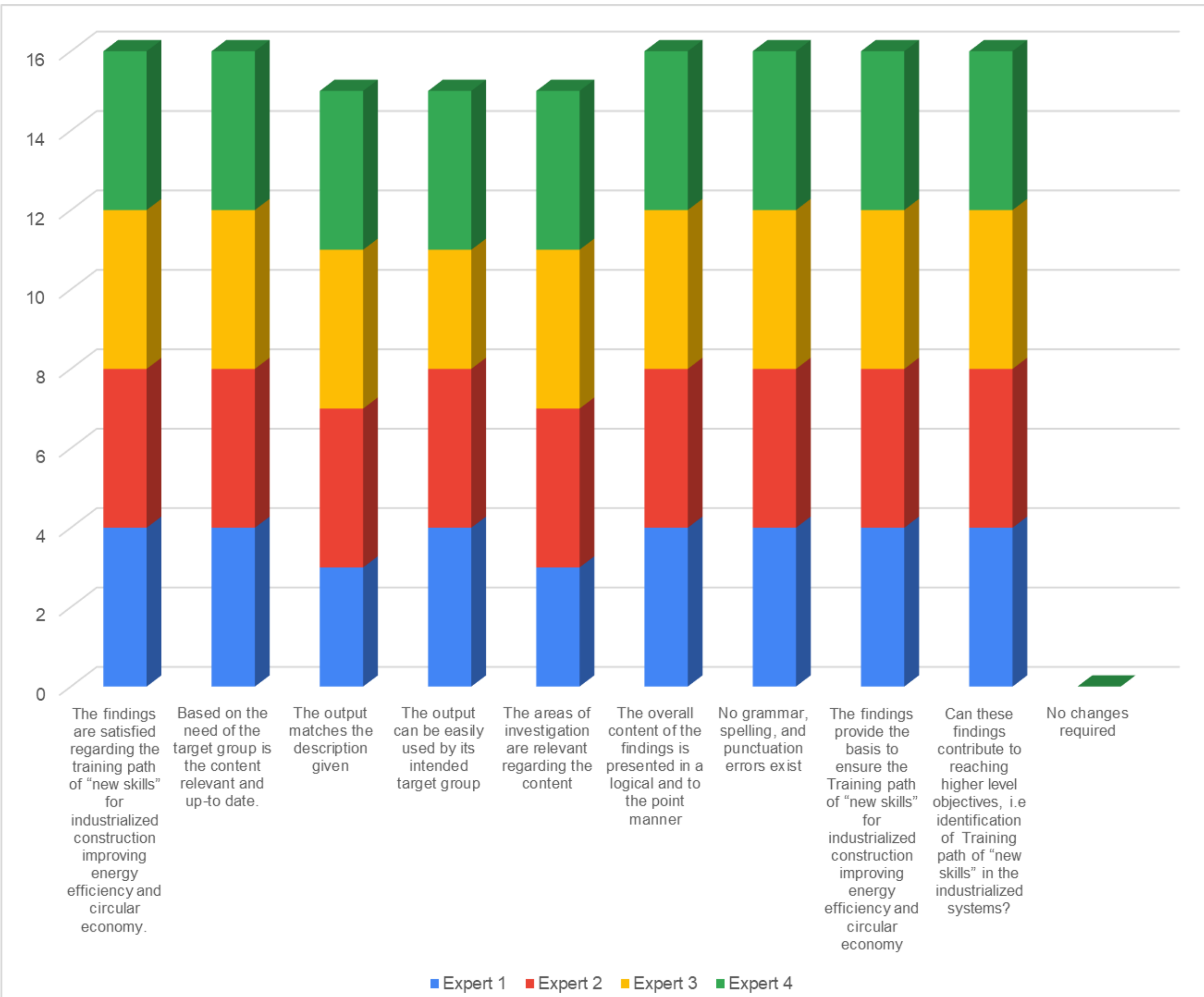
	This course explains drivers of sustainability in construction and review sustainability policies. Also, it provides an overview of the current green rating systems for buildings. To deepen the understanding of the topic and its importance, variety of examples of sustainable construction as well as case studies of best sustainable practices and future trends of sustainable construction will be demonstrated.
Indicators	
Capacity	Topics covered in the course are: • Sustainability as a general concept and its importance in the construction sector • Sustainable Development Goals (SDGs) • Building and environmental legislation relevant to sustainability in construction industry • Sustainable waste management in construction • Circular Economy for a Sustainable Built Environment
Knowledge	

Title of the course *<Unit of competence>*	**Bricklayer**
Expected results	By successfully mastering the program, the participant will acquire theoretical knowledge and practical skills to be able to use bricks and blocks, structural tiles, stones for building paths, fences, walls, buildings and other structures, as well as to repair older buildings, monitor and work according to occupational health and safety regulations and communicate with co-workers and supervisors.
Indicators	

Capacity	
Knowledge	

Title of the course *<Unit of competence>*	**Façade worker**
Expected results	The main goal of the program is for the participant to acquire knowledge, skills and competences for the application of the basic techniques in the construction of facade walls with the correct use of the equipment and tools for production with modern materials, to be trained in the repair of worn and damaged facades applying principles of energy efficient buildings with the application of thermal and sound insulation.
Indicators	
Capacity	
Knowledge	

Annex 2. Detailed results of the validation process of proposed New skills map for North Macedonia



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