WP3“Setting the professional skills”

Survey report in National context of the Republic of North Macedonia

K&S Centre

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Associated partner

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Executive Summary

"BuildOffsiteEU: Off-site industry-towards innovation in construction sector" is a project co-funded by the European Commission under the framework of Erasmus+ Programme and is implemented in the following EU countries: Spain, Greece, Slovenia, Italy, North Macedonia.

One of the main tasks of the BuildOffsiteEU Project is to set the new professional skills, bridging skills gaps between "traditional occupations" and "upgraded occupations" of industrialised construction trough detailed analysis of sustainability principles from EE&CE perspective and their relation to industrialised construction procedures/processes and activities allows setting "green skills and competences" needed to qualify-requalify the "new workers".

The BuildOffsiteEU Project is identifying and establishing clear and validated links between skills of traditional profiles and those required by industrialised construction provides the construction workers with accurate information on their re-skilling needs in this innovative field.

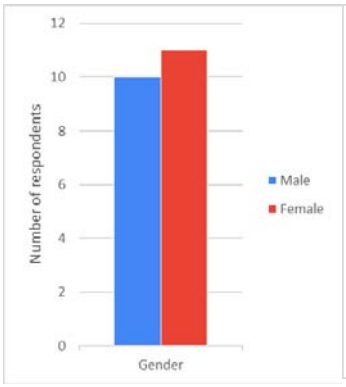
The Skills mapping of new workers highlights the skills gaps in the workforce and helps the main targets and beneficiaries of BuildOffsiteEU (especially VET centres, employers, and trainers) to identify their needs and the opportunities offered by this sustainable construction model.

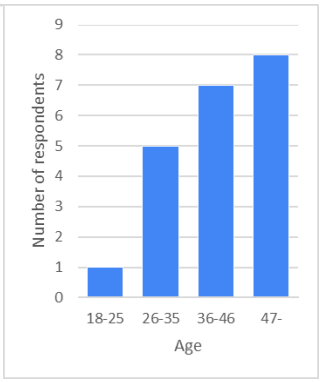
The realised research survey is addressed to rich information for the skills to be upgraded of workers to do industrialized construction, improving energy efficiency and circular economy, recommendation. This will produce the activities for developing new training schemes and curricula for workers in building sector.

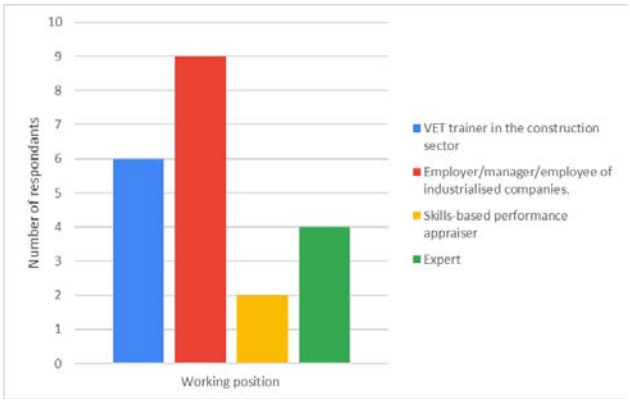
The online national survey of North Macedonia was realised form 25 December 2023 to 15 January 2024. The Google online survey was sent to K&S Centre national partners: employers/managers/employees of industrialized construction companies; experts and skills-based performance appraisers; VET trainers in the construction sector. The survey was filled out by 21 respondents.

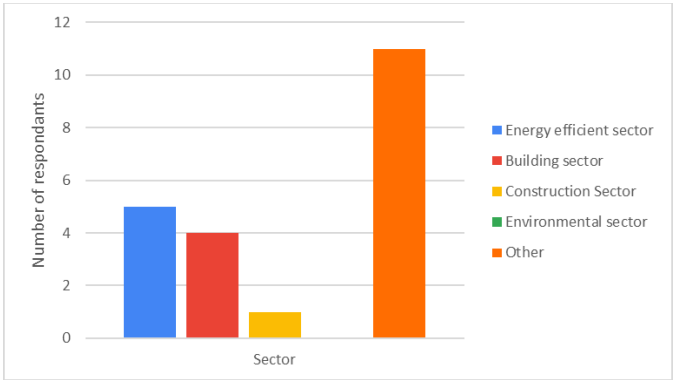
Profile of the participants in the interviews/focus groups

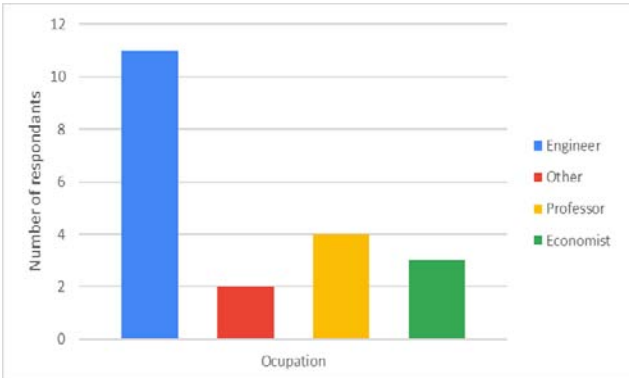
Information about the number of participants in the survey, their gender (Graph A), age (Graph B), working position (Graph C), sector (Graph D) and occupation (Graph E) are presented on the Graphs A-E. There is a gender balance between responders and 71% of them have age between 36 and more than 47 years old.











Presentation of the results from online national survey of North Macedonia

Four occupations are selected in correspondence with ESCO classification, having in mind to have been technicians in building sector who can cover most common building activities.

The selected occupations are well recognised in building sector:

1. Electrical installer – ESCO Code 7411.1 & 7411.1.1;
2. HVAC engineering technician – ESCO Code 3115.1.5;
3. Roof labourers; ISCO-08, Code 7121
4. Building construction labourers– ESCO Code 7114 & 7112.1.

The pool of skills for each of the occupations is prepared, including both existing "traditional skills" (extracted from ESCO database), and the skills to be upgraded necessary to adapt the respective occupation to contemporary practices and industrialised way of construction. The list of skills to be upgraded necessary for transition of the sector. The selected skills are devided in 3 categories: managerial, transversal and technical skills.

For each occupation, the respondents was questioned to select from the pool of the skills and to identify (decide) in which group the certain skill belongs: existing skills- what the workers currently know and are capable to do for selected occupations, named as “traditional skills”, or skills to be upgraded, necessary to enable successful transition of the sector in industrialized construction sector.

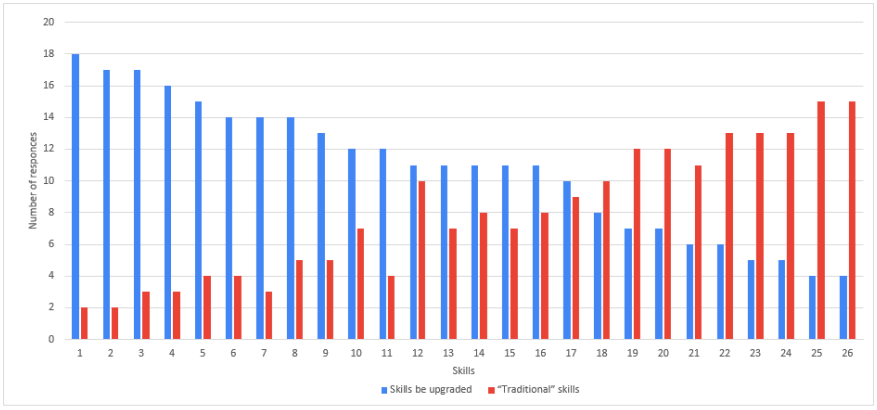
The main skills for the four occupations that need to be upgraded in the country related to industrialized construction, improving energy efficiency and circular economy are defined by the number of answers received for each of the skills in the questionnaire. The list of main skills that need to be upgraded have more selection “to be updated” than “traditional”.

1.Electrical installer

The existing “traditional” skills for Electrical installers define that they currently perform work indoor and outdoor in nearly every type of facility:

- Install and maintain electricity cables and other electrical infrastructure in buildings.
- Install and maintain electrical equipment and machinery.
- Make sure installed electrical equipment is isolated and presents no fire hazards.

On the Graph 1 is presented the results form the online survey for Electrical installer occupation. The blue bars represent the skills to be upgraded for Electrical installers, and red bars represent “traditional” skills.



Graph 1. “Traditional” skills and skills be upgraded for Electrical installer occupation.

The ranking of “traditional” skills for Electrical installer is followed:

1. Install wiring, lightning and protection system.
2. Repair wiring
3. Replace defect components.
4. Work under voltage.
5. Install electric switch boxes.
6. Measure electrical characteristics.

7. Provide power connection from bus bars.
8. Install electrical household appliances.
9. Work in a construction team.
10. Use measurement instruments.
11. Write inspection reports.
12. Test and resolve equipment malfunctions.
13. Check compatibility of materials
14. Install inverters.
15. Follow health and safety procedures in construction and working at heights.
16. Use precision tools.
17. Calculate solar panel orientation.
18. Assemble sensors.
19. Install automation components.
20. Use diagnostic tools for electronic repairs.
21. Calculate needs for construction supplies.
22. Interpret 2D and 3D digital plans.
23. Assemble electrical and mechatronic components and units.
24. Mount photovoltaic panels.
25. Use BIM models.
26. Install smart devices.

The ranking of most important skills to be upgraded for Electrical installer is followed:

1. Use BIM models.
2. Install smart devices.
3. Interpret 2D and 3D digital plans.
4. Assemble electrical and mechatronic components and units.
5. Install automation components.
6. Use diagnostic tools for electronic repairs.
7. Mount photovoltaic panels.
8. Calculate solar panel orientation.
9. Assemble sensors.
10. Install inverters.
11. Calculate needs for construction supplies.
12. Work in a construction team.
13. Follow health and safety procedures in construction and working at heights.
14. Test and resolve equipment malfunctions.
15. Use precision tools.
16. Check compatibility of materials.
17. Write inspection reports.
18. Use measurement instruments.
19. Measure electrical characteristics.
20. Provide power connection from bus bars.
21. Install electrical household appliances.

22. Replace defect components.
23. Work under voltage.
24. Install electric switch boxes.
25. Install wiring, lightning and protection system.
26. Repair wiring.

There is clear gap between "traditional" skills and skills be upgraded for Electrical installers. The main skills for Electrical installers that need to be upgraded in the country related to industrialized construction, improving energy efficiency and circular economy are followed:

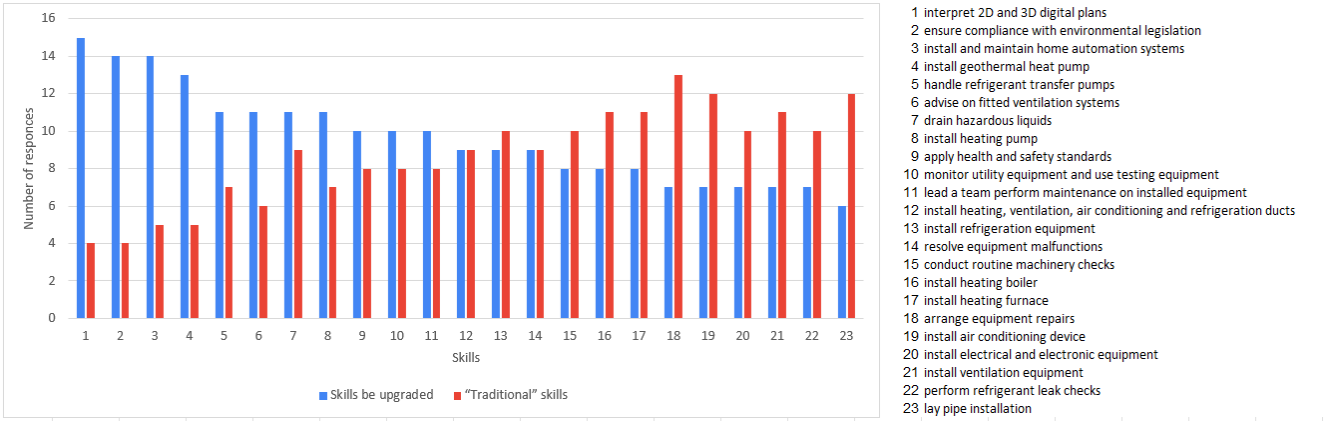
1. Use BIM models.
2. Install smart devices.
3. Interpret 2D and 3D digital plans.
4. Assemble electrical and mechatronic components and units.
5. Install automation components.
6. Use diagnostic tools for electronic repairs.
7. Mount photovoltaic panels.
8. Calculate solar panel orientation.
9. Assemble sensors.
10. Install inverters.
11. Calculate needs for construction supplies.
12. Work in a construction team
13. Follow health and safety procedures in construction and working at heights.
14. Test and resolve equipment malfunctions.
15. Use precision tools.
16. Check compatibility of materials.
17. Write inspection reports.

2. HVAC engineering technician

The existing "traditional" skills for HVAC engineering technician are:

- Aid in the design and installation of devices which provide heating, ventilation, air conditioning and possibly refrigeration in buildings.
- Ensure the equipment complies with environmental standards.
- Handle hazardous materials used in the systems.
- Ensure safety precautions are in place.

On the Graph 2 is presented the results form the online survey for HVAC engineering technician occupation. The blue bars represent the skills to be upgraded for HVAC engineering technicians, and red bars represent "traditional" skills.



Graph 2. "Traditional" skills and skills be upgraded for HVAC engineering technician occupation.

The ranking of "traditional" skills for HVAC engineering technician is followed:

1. Arrange equipment repairs.
2. Install air conditioning device.
3. Lay pipe installation.
4. Install heating boiler.
5. Install heating furnace.
6. Install ventilation equipment.
7. Install refrigeration equipment.
8. Conduct routine machinery checks.
9. Install electrical and electronic equipment.
10. Perform refrigerant leak checks.
11. Drain hazardous liquids.
12. Install heating, ventilation, air conditioning and refrigeration ducts.
13. Resolve equipment malfunctions.
14. Apply health and safety standards.
15. Monitor utility equipment and use testing equipment.
16. Lead a team perform maintenance on installed equipment.
17. Handle refrigerant transfer pumps.
18. Install heating pump.
19. Advise on fitted ventilation systems.
20. Install and maintain home automation systems.
21. Install geothermal heat pump.
22. Interpret 2d and 3d digital plans.
23. Ensure compliance with environmental legislation.

The ranking of most important skills to be upgraded for HVAC engineering technician is followed:

1. Interpret 2D and 3D digital plans.
2. Ensure compliance with environmental legislation.
3. Install and maintain home automation systems.

4. Install geothermal heat pump.
5. Handle refrigerant transfer pumps.
6. Advise on fitted ventilation systems.
7. Drain hazardous liquids.
8. Install heating pump.
9. Apply health and safety standards.
10. Monitor utility equipment and use testing equipment.
11. Lead a team perform maintenance on installed equipment.
12. Install heating, ventilation, air conditioning and refrigeration ducts.
13. Install refrigeration equipment.
14. Resolve equipment malfunctions.
15. Conduct routine machinery checks.
16. Install heating boiler.
17. Install heating furnace.
18. Arrange equipment repairs.
19. Install air conditioning device.
20. Install electrical and electronic equipment.
21. Install ventilation equipment.
22. Perform refrigerant leak checks.
23. Lay pipe installation.

There is clear gap between "traditional" skills and skills be upgraded for HVAC engineering technicians. The main skills for HVAC engineering technician that need to be upgraded in the country related to industrialized construction, improving energy efficiency and circular economy are followed:

1. Interpret 2D and 3D digital plans.
2. Ensure compliance with environmental legislation.
3. Install and maintain home automation systems.
4. Install geothermal heat pump.
5. Handle refrigerant transfer pumps.
6. Advise on fitted ventilation systems.
7. Drain hazardous liquids.
8. Install heating pump.
9. Apply health and safety standards.
10. Monitor utility equipment and use testing equipment.
11. Lead a team perform maintenance on installed equipment.

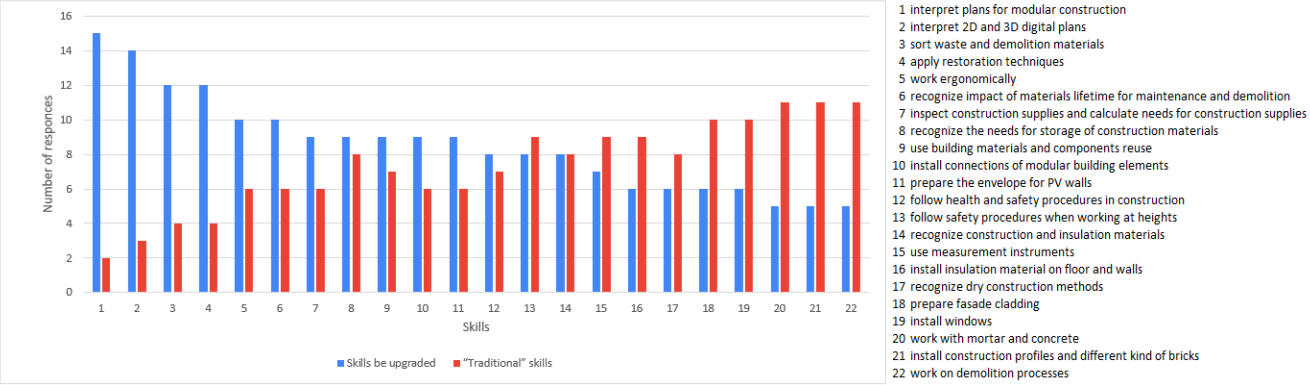
3. Roof labourer

The existing "traditional" skills for Roof labourer are followed:

- Cover structures with roofs.
- Shape and assemble elements for the construction of buildings and other structures.
- Use materials such as wood, plastic and metal in their creations.

- Install the weight-bearing elements of a roof, either flat or pitched.
- Cover roof with a weatherproof layer.

On the Graph 3 is presented the results form the online survey for Roof labourer occupation. The blue bars represent the skills to be upgraded for Roof labourers, and red bars represent "traditional" skills.



Graph 3. "Traditional" skills and skills be upgraded for Roof labourer occupation.

The ranking of "traditional" skills for Roof labourer is followed:

1. Operate tolls for cutting materials.
2. Inspect roof's installed gutters.
3. Lay roof tiles.
4. Build scaffolding.
5. Lay roof with materials for roofing like clay tile, asphalt composite shingles, built-up roofing and rolled roofing.
6. Install insulation material and roll roofing.
7. Use measurement instruments.
8. Install lightning protection system.
9. Assess conservation needs.
10. Install roof windows.
11. Apply restoration techniques.
12. Inspect construction supplies and calculate needs for construction supplies.
13. Follow safety procedures when working at heights.
14. Recognize construction and isolation materials.
15. Install connections of modular roof elements.
16. Sort waste and demolition materials.
17. Follow health and safety procedures in construction.
18. Construct roof structure with construction profiles.
19. Program a cnc controller.
20. Interpret 2d and 3d digital plans.
21. Prepare the roof for solar system (pv and solar thermal system)
22. Establish green roof.

The ranking of most important skills to be upgraded for Roof labourer is followed:

1. Interpret 2D and 3D digital plans.
2. Establish green roof.
3. Prepare the roof for solar system (PV and solar thermal system)
4. Apply restoration techniques.
5. Construct roof structure with construction profiles.
6. Inspect construction supplies and calculate needs for construction supplies.
7. Follow safety procedures when working at heights.
8. Sort waste and demolition materials.
9. Program a CNC controller.
10. Recognize construction and isolation materials.
11. Assess conservation needs.
12. Install connections of modular roof elements.
13. Follow health and safety procedures in construction.
14. Use measurement instruments.
15. Install lightning protection system.
16. Install roof windows.
17. Install insulation material and roll roofing.
18. Lay roof with materials for roofing like clay tile, asphalt composite shingles, built-up roofing and rolled roofing.
19. Inspect roof's installed gutters.
20. Lay roof tiles.
21. Build scaffolding.
22. Operate tolls for cutting materials.

There is clear gap between "traditional" skills and skills be upgraded for Roof labourer. The main skills for Roof labourer that need to be upgraded in the country related to industrialized construction, improving energy efficiency and circular economy are followed:

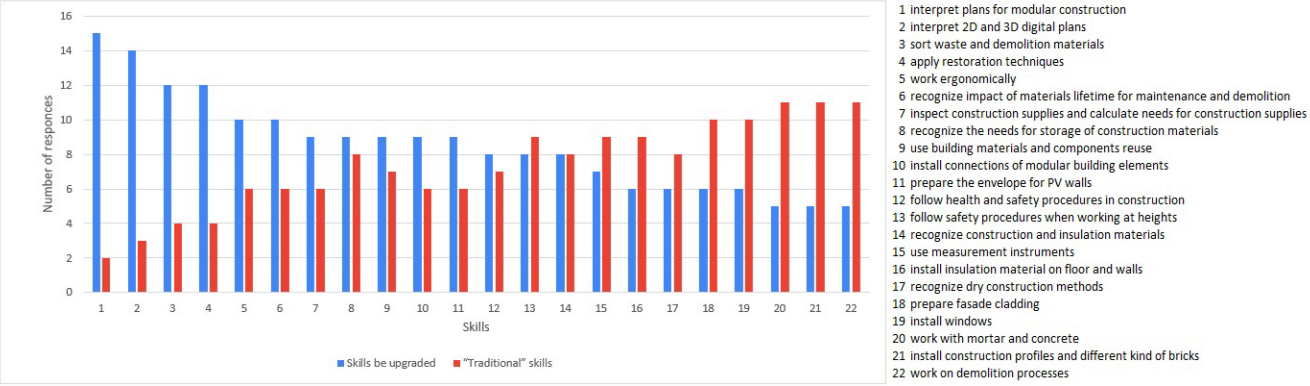
1. Interpret 2D and 3D digital plans.
2. Establish green roof.
3. Prepare the roof for solar system (PV and solar thermal system)
4. Apply restoration techniques.
5. Construct roof structure with construction profiles.
6. Inspect construction supplies and calculate needs for construction supplies.
7. Follow safety procedures when working at heights.
8. Sort waste and demolition materials.
9. Program a CNC controller.
10. Recognize construction and isolation materials.
11. Assess conservation needs.
12. Install connections of modular roof elements.
13. Follow health and safety procedures in construction.
14. Install roof windows.

4. Building construction labourer

The existing “traditional” skills for Building construction labourer are followed:

- Perform routine tasks in connection with building construction and demolition work.
- Assemble walls and structures by skilfully laying the different kind of bricks in an established pattern, using a binding agent like cement to bond the bricks together.
- Fill the joints with mortar or other suitable materials.

On the Graph 4 is presented the results form the online survey for Building construction labourer occupation. The blue bars represent the skills to be upgraded for Building construction labourer, and red bars represent “traditional” skills.



Graph 4. “Traditional” skills and skills be upgraded for Building construction labourer occupation.

The ranking of “traditional” skills for Building construction labourer is followed:

1. Work with mortar and concrete.
2. Install construction profiles and different kind of bricks.
3. Work on demolition processes.
4. Prepare fasade cladding.
5. Install windows.
6. Follow safety procedures when working at heights.
7. Use measurement instruments.
8. Install insulation material on floor and walls.
9. Recognize the needs for storage of construction materials.
10. Recognize construction and insulation materials.
11. Recognize dry construction methods.
12. Use building materials and components reuse.
13. Follow health and safety procedures in construction.
14. Work ergonomically.
15. Recognize impact of materials lifetime for maintenance and demolition.
16. Inspect construction supplies and calculate needs for construction supplies.
17. Install connections of modular building elements.

18. Prepare the envelope for PV walls.
19. Sort waste and demolition materials.
20. Apply restoration techniques.
21. Interpret 2D and 3D digital plans.
22. Interpret plans for modular construction.

The ranking of most important skills to be upgraded for Building construction labourer is followed:

1. Interpret plans for modular construction.
2. Interpret 2d and 3d digital plans.
3. Sort waste and demolition materials.
4. Apply restoration techniques.
5. Work ergonomically.
6. Recognize impact of materials lifetime for maintenance and demolition.
7. Inspect construction supplies and calculate needs for construction supplies.
8. Recognize the needs for storage of construction materials.
9. Use building materials and components reuse.
10. Install connections of modular building elements.
11. Prepare the envelope for pv walls.
12. Follow health and safety procedures in construction.
13. Follow safety procedures when working at heights.
14. Recognize construction and insulation materials.
15. Use measurement instruments.
16. Install insulation material on floor and walls.
17. Recognize dry construction methods.
18. Prepare fasade cladding.
19. Install windows.
20. Work with mortar and concrete.
21. Install construction profiles and different kind of bricks.
22. Work on demolition processes.

There is clear gap between “traditional” skills and skills be upgraded for Building construction labourer. The main skills for Building construction labourer that need to be upgraded in the country related to industrialized construction, improving energy efficiency and circular economy are followed:

1. Interpret plans for modular construction.
2. Interpret 2d and 3d digital plans.
3. Sort waste and demolition materials.
4. Apply restoration techniques.
5. Work ergonomically.
6. Recognize impact of materials lifetime for maintenance and demolition.
7. Inspect construction supplies and calculate needs for construction supplies.
8. Recognize the needs for storage of construction materials.
9. Use building materials and components reuse.
10. Install connections of modular building elements.

11. Prepare the envelope for pv walls.
12. Follow health and safety procedures in construction.

Key conclusions reached, as well as recommendations for the "skills to be upgraded" of industrialized construction and key criteria in terms of sustainability for industrialized construction

The number of main skills for the four occupations that need to be upgraded in the country related to industrialized construction, improving energy efficiency and circular economy are:

- Electrical installer – 17.
- HVAC engineering technician - 12.
- Roof labourer – 14.
- Building construction labourer – 12.

Among the 4 occupations-target groups, Electrical installer is the one with the need to upgrade more skills, 17 from selected. The other three occupations have between 12 and 14 skills to be upgraded.

For all 4 occupations, skills related to new technologies, energy efficiency and circular economy are qualified as deemed to upgrade. The skills: management of waste and demolition materials; installation and maintenance of PV and solar thermal systems; use of new techniques like green roofs, geothermal heat plants, 2D and 3D digital plans, use BIM models are recognized as new skills to be upgraded.

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