

Work-based learning system to up-skilling construction workers in wood construction methods for energy efficient buildings

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Abstract

Nowadays, the use of wood is becoming increasingly relevant in the field of construction and design, and as a result, this material is becoming essential in construction materials market. However, the current skills of workers and apprentices are not up to the new demands of the market, and this is because the knowledge and skills obtained through the WBL do not meet the needs in the workplace for timber constructions and workings. In addition, strict renovation requirements and political measures that seek to stimulate the transformation of existing buildings make this lack of skills even more noticeable. Thus, in this article we will see how this UP-WOOD project proposes to pay attention to the need of improving skills and abilities in this sector, through a work-based learning system VET (Vocational Education and Training), so current and future demand of efficient energetic solutions can be solved.

Keywords: *Woodworking; Construction site managers; Specific training; Efficient learning.*

Introduction

Construction with wood yields high energy efficiency value, becoming increasingly relevant in the construction materials market. Simultaneously, construction with wood fulfils the central aims of EC Construction 2020 communication campaign to strengthen energy efficiency training in the construction sector. Advantages of wood in construction include its high level of reusability (e.g. in cascading, biomass, recycling), its modularity, and its ability to be 'designed for deconstruction'. For these reasons, construction with wood is aligned with EC's targets for near-zero energy buildings.

Correspondingly, skills relevant to innovative woodworking methods & applications are now among the top-5 in-demand skills in the EU construction market. In fact, it is expected

that over 3mil construction workers in Europe will need to build-up their skills in the building sector in relation to energy efficiency by 2020, with specialized training in areas of high demand such as energy efficient & innovative woodworking skills.

“In the 1950s and 1960s, 5.2 million tonnes of conventional woodbased construction materials (mainly sawn wood) were consumed on average every year. Between 1990 and 2010 this number was 6.4 million tonnes. (...) In the last two decades the technical innovations of engineered timber products and their production processes,(...)have facilitated growth in the construction of multi-storey buildings made of wood.” (Hildebrandt. et al, 2017; Cárceles et al, 2016; Peñalvo et al, 2017)

Work-Based Learning (WBL) is well established in the construction sector, as the vast majority of construction businesses offer on-site apprenticeship programs. Nevertheless, the construction industry notes a gap between the skills and knowledge acquired by apprentices through WBL and those needed in the workplace. Stringent renovation requirements and policies measures seeking to stimulate the transformation of existing buildings (e.g. Energy Performance of Building Directive) and the fast-paced emergence of relevant new markets (e.g. green building) necessitate the reskilling of construction workers to work with greener products and processes (Fuller et al., 2005; McDonald et al., 2007).

This brings woodworking skills to the forefront of green construction methods, since wood is the most environmentally-friendly, safe, and energy efficient material in the construction materials market; novel high-tech wood processes and products (e.g. CLT timber) based on novel construction methods with wood (e.g. AI-assisted processing) essentially create a need to train workers on new materials and processes, to meet the anticipated demand for energy efficient solutions in the construction and renovation sector(QPID, 2000)

“A growing body of knowledge suggests that building with wood-based material can result in lower energy use and CO₂ emission compared to other materials such as concrete, brick or steel. For example, Koch, using US data from the 1970s, and Buchanan and Honey using New Zealand data from the 1980s, calculated energy use and CO₂ emission to be lower if wood materials are used for building construction. More recently, CORRIM found two wooden houses to have lower embodied energy and global warming potential than equivalent designs made of steel or concrete. Other studies, while also concluding that wood construction can use less energy and emit less CO₂, have emphasized the spatial, temporal and technological differences that affect the energy and CO₂ balances of material production. UNHABITAT explored the causes of variability of energy use in building material production introduced by process-specific differences in production methods. Buchanan and Levine found that the energy needed to manufacture building materials decreased between 1983 and 1998, and in both periods the buildings with higher wood content had lower CO₂ emission than those made of concrete or steel (Gustavsson.L. & Sathre.R., 2005).

Project objectives

UPWOOD is a project co-funded by the European commission, which forms a Strategic Partnership to improve work-based learning VET, by developing and making available educational resources to address current and emerging occupational skills needs for energy efficient and innovative woodworking construction practices. The UPWOOD specific objectives are to:

- a) Develop new training content (i.e. WBL educational resources) on energy efficient wood construction methods and applications.
- b) Develop teaching materials, VET integration guidelines, and trainer's guide to support VET providers to integrate new woodworking technologies and processes into their WBL and apprenticeships offerings.
- c) Improve cooperation between VET providers and businesses to provide opportunities that will enable learners to apply the acquired knowledge and skills in real-life workplace situations.

In order to develop this project, and consider it as successful, a set of outcomes are expected to be accomplished by the end of the development:

- Learning outcomes for training provision in innovative & energy efficient woodworking technologies, methods, and applications in construction for current and future construction workers.
- Learning units (curriculum structure), trainers' guide, and VET integration guidelines.
- Open Educational Resources for woodworking technologies, methods, and applications in the construction sector.
- UPWOOD Online Training Scenarios & content on woodworking technologies, methods, and applications in construction for current and future construction workers.
- A Certificate Supplement for the integration of woodworking in construction skills into certification schemes.
- A position paper to support decision-making and promote the incorporation of woodworking in construction skills requirements into the European e-Cornpetence Framework.
- 5 national information days (one in each partnership country) to promote project results and set an open discussion on increasing the quality and effectiveness of VET provision.

Aiming to successfully carry the project with all its outcomes, the target groups to include in the project interests are the following:

- Construction sector employers
- Woodworking sector workplace trainers/mentors
- VET providers

- 1-VET students (i.e. apprentices) aspiring to get employed in the construction industry
- C-VET students that need to up-skill themselves to strengthen employability or job security
- Representatives and associations of employers and employees in the construction sector
- Policy makers/ Regulators or related bodies

The partnership comprises of 5 organisations, from 5 european countries, with high capacity, qualifications and complementary skills from the world of VET and employment, with direct links to apprenticeships, to align mentors' training with specific labour market needs and apprenticeship particularities and meet requirements in terms of efficiency, innovation, and timely implementation.

The partnership formation will combine partners' complementary expertise to address the particular challenges related to the professionalization of mentors and workers in woodworking and timber construction apprenticeships, following a systematic, European VET approach.

Overview of project outputs, activities, and events

The following list provides an overview of the intellectual outputs and multiplier events of the UPWOOD project, which will be described in detail in section 5:

1. VET learning outcomes for training provision in environmentally-friendly and energy efficient innovative woodworking construction practices, validated by trainers and field experts (01).
2. Formal VET learning units on innovative energy efficient woodworking construction methods & applications, and VET integration guidelines (02).
3. Open Education Resources (OERs) for training construction sector professionals and apprentices in innovative & energy efficient woodworking technologies and applications (02).
4. UPWOOD online practical scenarios infrastructures and content in innovative & energy efficient woodworking construction methods & applications for construction sector professionals & apprentices (03).
5. A statement of support for the validation/recognition of the UPWOOD units of learning outcomes (04).
6. A framework for the integration of energy efficient woodworking skills requirements into the EU certification and standardisation schemes (04).
7. Five (5) national information days in Austria, Latvia, Greece, Spain, and Finland to share and disseminate UPWOOD results (E1-5).

Outputs UPWOOD

Some of the main outputs of the Upwood project are:

Output Identification - IO1

Output Title - UPWOOD work-based learning outcomes.

Output description - Development of needed learning outcomes to successfully complete the UPWOOD course. To specify the necessary learning outcomes, current and future training needs will be investigated, based on the emergence of new market niches, technological changes and changes in customer expectations.

The primary objective of this output is to make available up-to-date, tailor-suited to occupational needs, innovative woodworking learning outcomes, suitable for integration into construction sector WBL provision

Output Identification - IO2

Output Title - UPWOOD learning units and Open Educational Resources (OERs)

Output description - This output includes the development of a modular WBL curriculum structure (syllabus) that can be used by VET providers and employers for training construction sector apprentices and workers, to facilitate energy efficient and innovative woodworking skills acquisition. Each learning unit will consist of a unique set of learning outcomes, defined in terms of knowledge, skills and competences, which can be assessed and validated in a consistent and coherent approach (table 1).

<u>code</u>	<u>Task</u>	<u>Description</u>
O2-T1	Clustering of learning outcomes into UPWOOD learning units	This task will cluster the defined learning outcomes into learning units, referring to thematic subject areas, such as the following: 1: Knowledge of the qualities of wood & its various applications in construction. 2: New technological methods for woodworking. 3: Innovative energy efficient applications of wood in buildings. 4: Renovation & designing for deconstruction. In addition, this task includes the development of specifications for each learning unit addressing practical and theoretical pedagogical orientations.
O2-T2	UPWOOD training and assessment material	This output Develops training resources and assessment materials based on the UPWOOD units of learning outcomes. Certain types of training materials will be created to support practical learning on real-life work situations and duties.
O2-T3	Development of trainer handbook with WBL guidelines for VET providers and construction sector employers	This task involves the development of a) a toolkit to assist trainers in designing/running WBL programmes for training in innovative woodworking practices and applications in the construction sector, and b) the creation of a practical guide for VET providers and employers to facilitate the integration of the developed units of learning outcomes into WBL schemes within the construction sector.

Table 1. Tasks and description of output IO2

Output Identification - IO3

Output Title - Online training scenarios.

Output description - This output comprises the development of online training scenarios that will help workers & apprentices undergoing WBL acquire new skills/experience. Scenarios will be used on-site and complementarily with other educational resources. Workers will assume a role in a practical 'real life' workplace situation (e.g. Cross-Laminated Timber applications, wooden insulation) to make informed decisions about the best way to perform their work duties in terms of energy efficiency. It will also be possible for learners (workers and/or apprentices) will obtain a score for their overall performance (table 2).

<u>code</u>	<u>Task</u>	<u>Description</u>
O3-T1	Scenario-based assessment methodology for UPWOOD learners	This activity will elaborate on a scenario-based learning methodology that will define the pedagogical principles and instructional design of the UPWOOD training scenarios. At a first stage, the methodology will discuss the educational value and characteristics of scenarios in WBL, a) specifying the pedagogical and training needs of UPWOOD learners, b) setting measurable learning objectives, and c) describing trainers' role and responsibilities.
O3-T2	Development of training scenarios	This activity includes the development of 4 scenarios in the form of flowchart stories (branching scenarios) that will simulate real-life working situations, and will be applicable to all types of construction (e.g. construction, renovation, demolition).
O3-T3	Selection & deployment of the UPWOOD online tool	This activity includes researching and selecting the most suitable online tool/platform that will host the 4 practical scenarios, including the following actions: a) Identification of appropriate platforms to support the UPWOOD pedagogical model. b) Deployment of training scenario infrastructures, including the authoring of descriptive materials to facilitate the navigation of learners throughout the online tool content in English and the 5 partnership languages.
O3-T4	Mentors' guide	This task involves the development of a guide to assist construction workplace mentors in using the training scenarios to support WBL in construction. The guide will describe the pedagogy of the scenarios and the instructional design followed, providing guidelines on how to use the UPWOOD tool for assessing workers' & apprentices' performance in construction WBL. It will also provide guidelines on drafting practical scenarios suited to business' distinct needs and training priorities.

Table 2. Tasks and description of output IO3

Output Identification - IO4

Output Title - Framework for the integration of environmental components into construction sector WBL curricula and certification schemes

Output description - This output comprises the establishment of a framework, to a) facilitate the validation of project materials (i.e. learning outcomes and educational resources) in line with EU mobility and transparency framework & tools, b) lay the ground for the establishment of a certification scheme for innovative and energy efficient woodworking skills in construction, c) promote the integration of innovative, energy efficient woodworking skills requirements into occupational standards, and d) support decision making on work-

based learning and skill development policies. The consortium aspires that this output will function as a link between the partnership, VET providers, employers, and policy-makers (table 3).

code	Task	Description
O4-T1	Statement of support for the recognition of UPWOOD learning outcomes	This activity includes the development and subsequent endorsement of a statement of support on the validity of UPWOOD learning outcomes. The aim of this statement is to involve stakeholders in the mutual recognition of learning outcomes, also contributing to workforce mobility and transparency in vocational qualifications.
O4-T2	Position paper to promote the quality of work-based learning within the construction sector	This task involves the development of a position paper addressed to bodies and stakeholders that are active in the construction sector and/or participate in policy-making consultation. The purpose of the paper is to a) foster the integration of environmental and energy efficient woodworking skills and knowledge requirements into occupational standards/job profiles, b) promote the collaboration between VET centres and construction employers, and c) influence policy-making towards initiatives that aim to increase the supply and quality of work-based learning, providing incentives for construction employers to engage in WBL and better aligning training content with actual workplace requirements.
O4-T3	Creation of a Certificate Supplement	This task includes the creation of a Certificate Supplement (template) to be provided to workers and apprentices having successfully attended a WBL program that incorporates environmental and energy efficiency components. The Certificate Supplement is a document providing additional information to that included in the official vocational training certificates and/or transcripts. The Certificate supplement will be issued by VET providers that have integrated the UPWOOD learning outcomes into their training offerings.

Table 3. Tasks and description of output IO4

Conclusions

The European project UPWOOD aims to improve the skills relevant to innovative woodworking methods of workers and apprentices in the construction sector.

The need to create this project arises because, although those skills are in high demand in the EU construction market, construction employers note a gap between the skills and knowledge acquired by workers and apprentices through Work-Based Learning (WBL) in the construction sector and the woodworking skills needed in the workplace.

Thus, UPWOOD gets to improve work-based learning VET, by developing and making available educational resources to address current and emerging occupational skills needs for energy efficient and innovative woodworking construction practices. The main objectives of this project are: a) Develop new training content on energy efficient wood construction methods and applications. b) Develop teaching materials, VET integration guidelines, and trainer's guide to support VET providers to integrate new woodworking technologies and processes into their WBL and apprenticeships offerings. C) Improve cooperation between VET providers and businesses to provide opportunities that will enable learners to apply the acquired knowledge and skills in real-life workplace situations.

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