REPORT ON

Commonest refurbishment processes

Co-funded by
the European Union

Commonest refurbishment processes report

EU Lifelong Learning Programme 2007-13

Subprogramme Leonardo da Vinci - Call for proposal 2013

Action "Multilateral Projects for Transfer of Innovation"

Project Code:

LDV-TOI. 2013-1-ES1-LEO05-66235

This project has been funded with support from the European Commission.

The report was created within the Leonardo da Vinci (LdV) projects No: LDV-TOI. 2013-1-ES1-LEO05-66235, entitled: "**AR-key – Augmented Reality applied to training on key competences**". Labour Foundation for Construction was the Promoter of the Projects.

The following organisations were Partners in the AR-key Project:

- Bildungszentren des Baugewerbes e.V. (Germany),
- Centro de FormaÇao Professional de Industria da ConstruÇao Civil e Obras Públicas do Sul (Portugal),
- Fundación Laboral de la Construcción (Spain),
- Universitat de València. Instituto Universitario de Investigación Robótica y Tecnologías de la Información y Comunicación (Spain),
- Fundatia Romano-Germana Timisoara (Romania).
- Centro Edile Andrea Palladio (Italy)
- Ente Nazionale per la Formazione e L´Addestramento Professionale Nell´Edilizia (Italy)

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Introduction

Data show that people with lower level of key competences have up to 1,8 times more probability to be unemployed than those with higher levels. Hence, these unskilled adults lack the necessary "skills" to carry on with higher level of training, a situation that impedes them their requalification which, particularly in developing economies, represents a clear exclusion of them, not only from the education and training system but also from the labour market.

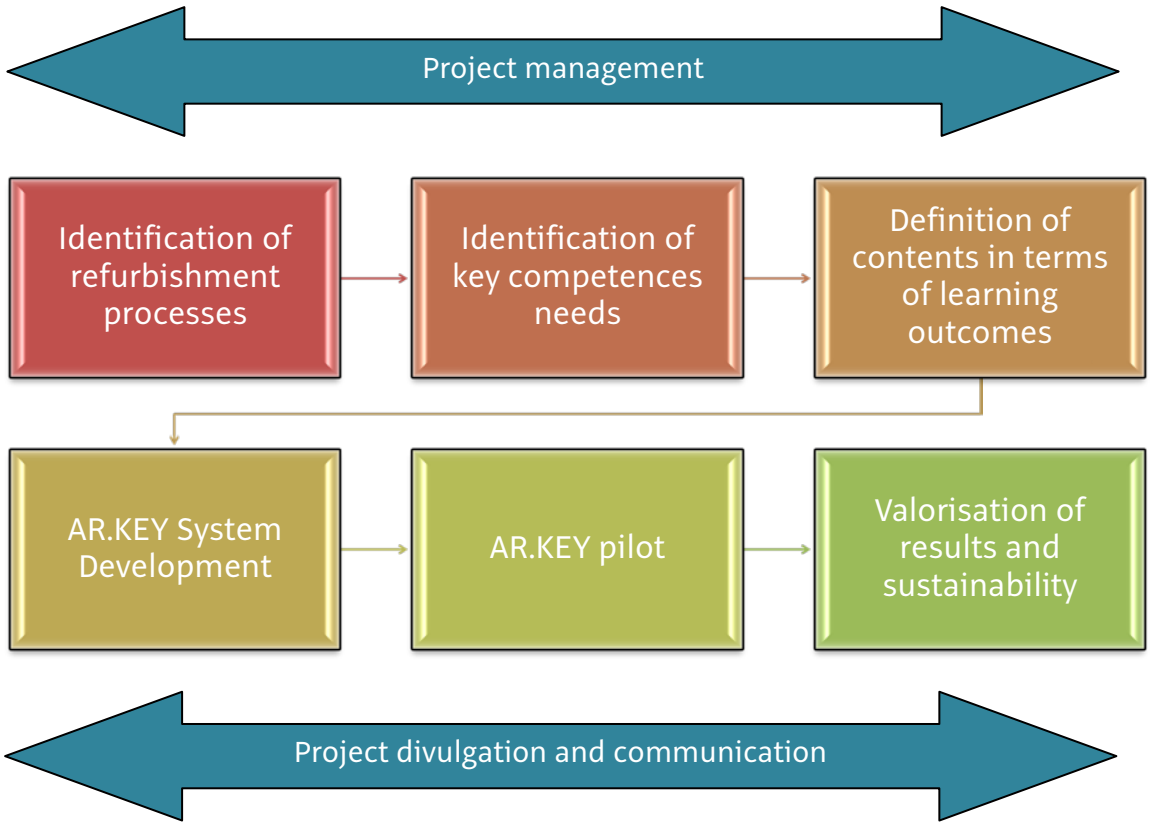
This is the main problem that AR.KEY project intends to deal with: the EU construction industry is a common destination of people from school failure, whose low knowledge base (arithmetic, calculation, etc.), hinders them to learn and perform more complex tasks. This failure dooms, in the best-case scenario, these workers to perform tasks of peonage despite the fact that they could develop competencies of higher responsibility or, in the worst case scenario, to the long-term unemployment.

Thus, this project aims at designing and applying a training system for non-qualified workers from construction industry, in order to improve their mathematical competence and basic competences in science and technology, keys to successfully follow up their training and hence their professional career.

AR.KEY will be organize in learning outcomes using EQF methodology and based on Augmented Reality (AR), which is a live, direct or indirect, view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data, enhancing one's current perception of reality. The final application will be available for using on tablets and/or smartphones on markets such as Google Play (ANDROID) or Apple Store (APPLE).

Therefore, the training system aims at improving the professional skills of unskilled workers from the building sector in those productive processes related to the comprehensive refurbishment of a building. For this purpose, the system will be structured in training modules sequenced in a very easy way, being supported by AR as well as other multimedia resources, in order to train students in those key competences necessaries to better understand more complex procedures such as the refurbishment, maintenance and conservation of covers, installations, facades and structures, or the energy restoration (energy efficiency and/or renewable energy systems) of a building.

8 WP has been set up to achieve project objectives:



The partnership is formed by 7 partners coming from 5 different countries, experts especially in vocational training in the building industry.

Logo	Coordinator	Country
FUNDACIÓN LABORAL DE LA CONSTRUCCIÓN	www.fundacionlaboral.org	

Logo	Partners	Country
BZB Bildungszentren des Baugewerbes e.V.	www.bzb.de	
Cenfic Centro de Formação Profissional da Indústria da Construção Civil e Obras Públicas do Sul	www.cenfic.pt	
FORMEDIL ENTE NAZIONALE PER LA FORMAZIONE E L'ADDESTRAMENTO PROFESSIONALE NELL'EDILIZIA ANCE FENEAL-UIL FILCA-CISL FILLEA-CGIL	www.formedil.it	
	www.frgtim.ro	
CENTRO EDILE ANDREA PALLADIO DAL 1948	www.centroedilevicenza.it	
IRTIC VNIVERSITAT DE VALÈNCIA	http://smagris3.uv.es/irtic	

To start the work a first step has to be the selection of the productive processes associated with conventional refurbishment as well as those related to energy restoration of buildings (WP2).

Contents

1. Identification of the commonest refurbishment processes

1.1. WP practical information

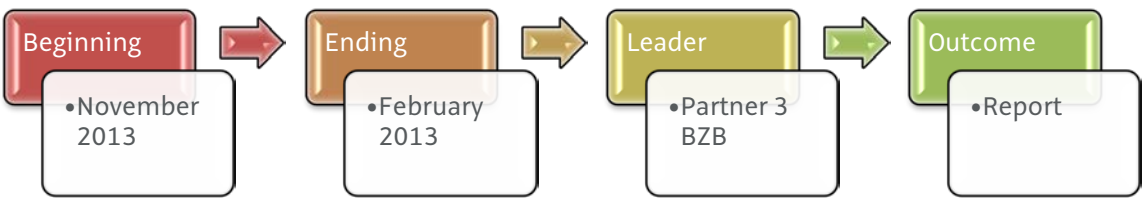


Figure 1. Timetable, leader and outcome of WP2

1.2. Methodology

The project implements two kinds of activities in order to set up these processes:

A. **Documentary analysis:** analysis of statistics, reports, partners' know-how and the like with the aim of identifying what types of refurbishment and energy restoration activities are carried out most habitually in each country. The following activities have been considering to be analysed:

Conventional refurbishment	Energy restoration
✓ Modernization of surfaces ✓ Previous demolition and internal partition wall ✓ Structural elements ✓ Accessibility and elevators ✓ Replacement of windows ✓ Electric installations ✓ Renovation of bathroom ✓ Renovation of kitchens ✓ Renovation of roofs ✓ Renovation of roofs. Non-sloping roofs ✓ Special field of renovation / modernization	✓ Modernization of heating systems ✓ Insulation from outside ✓ Insulation of windows ✓ Insulation of roofs ✓ Insulation from inside ✓ Air conditioning

This first documentary analysis approach was carried out by the **German partner BZB** (the leader of the first) as well as honing by the Spanish partner FLC**.**

B. **Focus group:** a focus group has been organized with experts (trainers, professionals, employers, trade unions, public bodies, etc.) in each of the partner countries in order to identify and define, on the basis of the previous analysis, what kinds of processes will be part of the final system.

1.3. WP2 tasks and activities

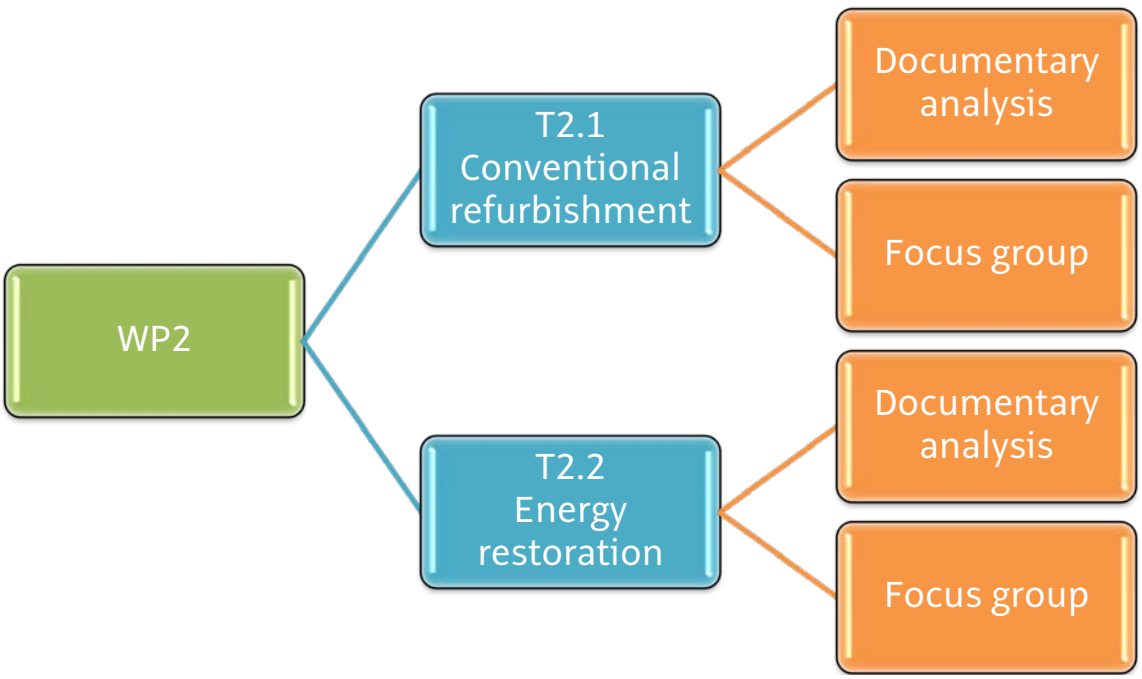


Figure 2. WP2 tasks and activities

2. Documentary analysis

2.1. Conventional refurbishment

2.1.1. Modernization of surfaces

One of the most regular and common works are the modernization of the **surfaces**. That means on the one hand painting or wall papering and on the other hand laying of carpet, laminate (artificial floor panels with wooden appearance) parquet floor or natural stone or tiles.

Aim	Regularity	Who
Improvement of decorative aspects. Not only to be up to date but also for the sense of well being.	Walls every 5-10 years. Floors: 10-20 (more) years.	Skilled Workers: painter, floor cover layers, parquet layers, joiner, tillers

Figure 3. WP2 tasks and activities. Modernization of surfaces

2.1.2. Previous demolition and internal partition wall

One almost unavoidable work in the modernization of the building is the relocation of a part of the original construction. So is necessary a previous demolition and relocation of the original walls. That means on the one hand a demolition process of the original walls distribution and on the other hand a new internal partition walls.

Aim	Regularity	Who
Improvement of deconstruction and material supply aspects. Specially to keep the structure safe. But not only for that if not because of special needs.	Walls every 30-40 years (depending on use).	Skilled Workers: professionals of deconstruction, bricklayers.

Figure 4. WP2 tasks and activities. Walls

2.1.3. Structural elements

One of the most important previous steps in the refurbishment is the modernization or reparation of the structural elements, pillars or floors (reinforced concrete) for example.

Aim	Regularity	Who
New modern technique and materials for more safety and durability structures.	Structural elements (30 – 40 years or more).	Skilled Workers: formwork operators

Figure 5. WP2 tasks and activities. Structural elements

2.1.4. Accessibility and elevators

Accessibility solutions are needed specially because the evolution of this concept grown up in the last few years. It means that the majority of these buildings in rehabilitation process would need to have these systems to do comfortable and accessible to everybody. Really often, the old buildings in rehabilitation process didn´t had an elevator. In particular those buildings inhabited by the elderly, needs this equipment for a normal stile of life (without external help).

Aim	Regularity	Who
Improvement of decorative aspects. Not only to be up to date (applicable obligation, depending on the heights of the building) but also for the sense of well being.	Accessibility every 10-20 years. Elevators: 10-20 (or more) years.	Skilled Workers: bricklayers, electricians (with specific training and skills)

Figure 6. WP2 tasks and activities. Accessibility

2.1.5. Replacement of windows

Replacement of old windows against new modern up to date windows is a very common refurbishment processes.

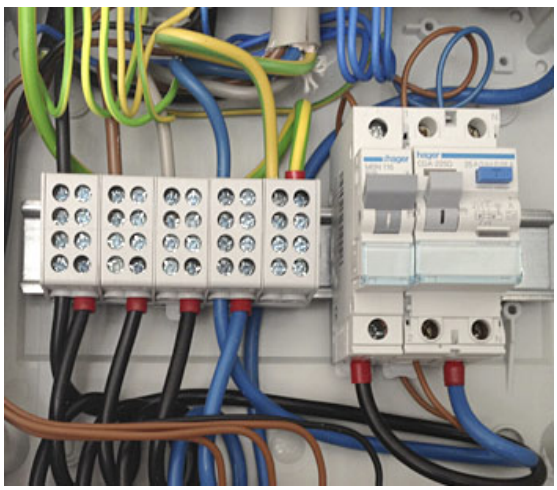
Old windows with wooden frame and one pane will be replaced by modern multi pane windows with wooden or aluminium or plastic frames.

Aim	Regularity	Who
Improvement of decorative aspects or to get more natural illumination Improvement of sound and thermal insulation.	30 – 40 years (or longer).	Skilled workers: window assembler, joiner (wooden windows), roofer in case of roof-lights.

Figure 7. WP2 tasks and activities. Windows

2.1.6. Electric installations

Modernization of the electrical installations covering the wiring, sockets and outlets in order to improve the safety of the users and being up to date. Also for decorative and well being (domotic, fire fighting system...) aspects.



Aim	Regularity	Who
Improvement of decorative aspects. Not only to be up to date but also for the sense of well being.	20-30 years (one generation)	Skilled workers: electricians (because of safety)

Figure 8. WP2 tasks and activities. Electric installations

2.1.7. Renovation of bathroom

The renovation of the bathroom is a very common refurbishment processes as well. This often covers the whole installations like bath tub, shower, hand wash basin, the mountings/armatures and finally the renewing of the surfaces like new plaster or tiles.

Aim	Regularity	Who
New modern technique and water save and energy saving installations. New decorative and up to date techniques.	20-30 years (one generation)	Skilled workers: Sanitary installer / plumber, tiler, plasterer, painter

Figure 9. WP2 tasks and activities. Bathrooms

2.1.8. Renovation of kitchens

The renovation of the kitchens as well the renovation of bathrooms is very useful and common in the refurbishing projects. This often covers the whole installations like water hitters, new furniture (more capacity furniture), the piping system (with new materials) and finally the renewing of the surfaces like new plaster or tiles.

Aim	Regularity	Who
New modern technique and water and energy saving installations. New decorative and up to date techniques.	20-30 years (one generation)	Skilled workers: Kitchen installer / plumber, tiler, plasterer, painter

Figure 10. WP2 tasks and activities. Kitchens

2.1.9. Renovation of roofs

This kind of renovation means replacement of roof coverings like roof tiles. This process is often blended with placement of new thermal insulation.

Aim	Regularity	Who
Maintenance of the roof as a protective covering against climate like rain, snow, wind and sun. Energy saving aspects in the case of improving the insulating features of the roof.	25-30 years	Skilled worker: Roofer, Carpenter

Figure 11. WP2 tasks and activities. Roofs (sloping)

2.1.10. Renovation of roofs. Non-sloping roofs

This kind of renovation means replacement of roof coverings like roof tiles. This process is often blended with placement of new thermal insulation.

Aim	Regularity	Who
Maintenance of the cover (non-sloping roof) as a protective covering against climate like rain, snow, wind and sun. Energy saving aspects in the case of improving the insulating features of the cover.	25-30 years	Skilled worker: Installer of insulation and waterproofing materials

Figure 12. WP2 tasks and activities. Roofs (non-sloping)

2.1.11. Special field of renovation / modernization

Renovation in the sense of **restoring old (ancient) houses.** This comprises a very special field of renovation, called restoration.

Aim	Regularity	Who
To conserve the old origin of the building and construction and decorative aspects.	-	Skilled workers with additional formal qualifications in the field of restoration in their crafts, e.g. restoration for plastering – painting – masonry etc.

Figure 13. WP2 tasks and activities. (Restoration)

2.1.12. Replacement of dangerous materials

Replacement of hazardous and dangerous materials that may cause health problems like cancer, etc.

Houses of the 1960s and 1970s were often built with insulations and building materials containing dangerous ingredients. For instance, artificial insulations containing asbestos and fibres which cause lung cancer or wooden plaques with formaldehyde.

Aim	Regularity	Who
To decontaminate hazardous materials / for health and safety of inhabitants and third persons in nearer environment	-	Skilled workers like demolition experts and construction workers with additional formal qualifications in the field of clearance and decontamination

Figure 14. WP2 tasks and activities. Dangerous materials

2.2. Energy saving restoration

2.2.1. Modernization of heating systems

The modernization of the heating system or the installations of alternative energy using systems are very common procedures when renovating a house.

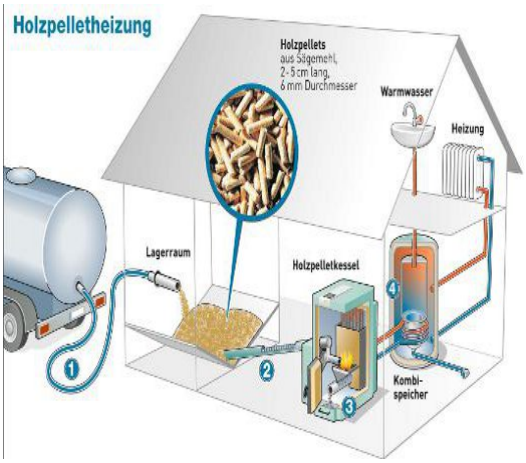
There are a large variety of possible modernizations in order to save energy and fossil fuels like oil and gas. Whether you replace an old oil heating system against a modern controlled special oil burning system sparing 30-40% fuel or you change from oil to gas fuel. Furthermore you have a lot of possibilities to combine a modern oil or gas heating system with alternative energy using technologies. These alternative technologies are solar heating, geothermal energy system, pellet heating, air heating valves or small block power stations.

Modernization of **oil heating system / change from oil to gas**:

Alternative energy system

Wood pellet heating system (supporting)

Solar heating system

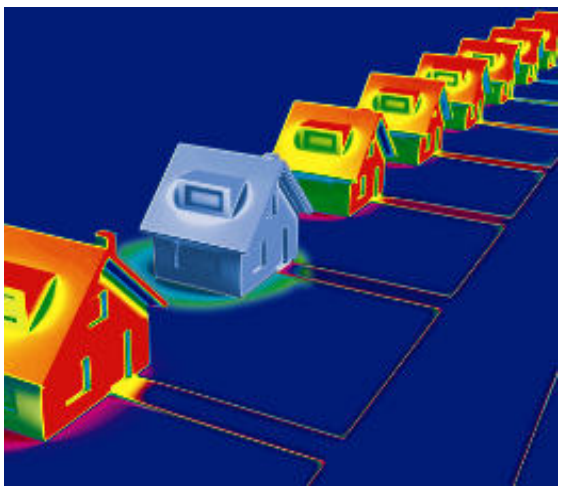


Aim	Regularity	Who
New modern technique to save energy and water.	Every 20-30 years (one generation) / introduction of new technologies / because of regulations and laws	Skilled workers: Sanitary installer / plumber / roofer

Figure 15. WP2 tasks and activities. Heating systems

2.2.2. Insulation from outside

Insulation of the outer shell of houses *from outside, in order to i*mprove the thermal insulation of the external walls and the roof by special thermal insulation façade systems.



Aim	Regularity	Who
To save energy and for more comfort.	Every 20-30 years (one generation) / introduction of new technologies / because of regulations and laws	Skilled workers: Plasterer, Painter

Figure 16. WP2 tasks and activities. Insulation from outside

2.2.3. Insulation of windows

Improving the insulation of the windows by replacing old windows against up to date windows is a very popular way to enhance the energy saving of a house.

Aim	Regularity	Who
To save energy and for more comfort.	Every 20-30 years (one generation) / introduction of new technologies / because of regulations and laws	Skilled workers: window assembler, Joiner (wooden windows), Roofer in case of roof-lights.

Figure 17. WP2 tasks and activities. Insulation of windows

2.2.4. Insulation of roofs

To enlarge the dimensions of the insulation or to use new materials of insulation can improve the energy saving very effectively.

Aim	Regularity	Who
To save energy and for more comfort.	Every 20-30 years (one generation) / introduction of new technologies / because of regulations and laws	Skilled workers: Roofer, carpenter.

Figure 18. WP2 tasks and activities. Insulation of roofs

2.2.5. Insulation from inside

Improving of the thermal insulation of the outer shell *from inside*, such as placement of thermal insulation on the external walls, ceilings or roof floors to improve the thermal conditions of the house.

Aim	Regularity	Who
To save energy and for more comfort.	Every 20-30 years (one generation) / introduction of new technologies / because of regulations and laws	Skilled workers: Plasterer, Painter, construction worker

Figure 19. WP2 tasks and activities. Insulation from inside

2.2.6. Air conditioning

Improving of the calculation systems to cool a specific area, such as placement of the air output or the freezeries needed depending on the surface of the building. The air conditioned may be installed by renewable energy as geothermic or solar installations.

Aim	Regularity	Who
To save energy and for more comfort.	Every 20-30 years (one generation) / introduction of new technologies / because of regulations and laws	Skilled workers: Plasterer, Painter, construction worker

Figure 20. WP2 tasks and activities. Air conditioning

3.Focus groups

3.1. Introduction

Each country carried out a focus group with different aims:

Country	Date	Attendees	Aims
Germany	24/01/14	- Project manager - Internal trainers	- To start the documentary analysis - To work out a first draft regarding the commonest refurbishment processes within the building industry
Spain	01/04/14	- Project manager - Project technicians - Engineering Faculty (UPM) - School of Industrial Organization (EOI) - National Association of Manufacturers of insulating materials (ANDIMAT) - AM Architecture and Urbanism - Institute of Construction Science Eduardo Torroja (CSIC) - Spanish Association for Quality (AEC)	- To review the first documentary analysis draft - To propose improvements to the first draft - To define a first proposal for the perimeter regarding the refurbishment processes that will be subject to inclusion on the final map - To start analyzing which key competencies are associated with each process
Italy	24/04/14	- Project managers - Internal trainers	- To apply a questionnaire in order to assess, validate and therefore reinforce the documentary analysis - To propose improvements to the documentary analysis
Romania	24/04/14	- Stakeholders	- To apply a questionnaire in order to assess, validate and therefore reinforce the documentary analysis - To propose improvements to the documentary analysis
Portugal	01/07/2014	- Trainers and trainees. - Qualified workers - Technical staff - Managers	- To apply a questionnaire in order to assess, validate and therefore reinforce the documentary analysis - To propose improvements to the documentary analysis

3.2. Germany

The partner BZB carried out a focus group to set up an initial documentary analysis regarding the commonest refurbishment processes within the building industry.

The results of this focus group have been reported in the section 2 of this document.

3.2. Spain

This focus group was carried out the 1st of April in the Labour Foundation for Construction headquarters with the attendance of several experts coming from different areas related to building industry.

After project presentation, first thing the experts did during this encounter was to harmonize the nomenclature that was chosen by project team to refer to conventional refurbishment and energy saving restoration. In this regard, they proposed to rename these two categories into two new ones, much more adapted to the building sector reality.

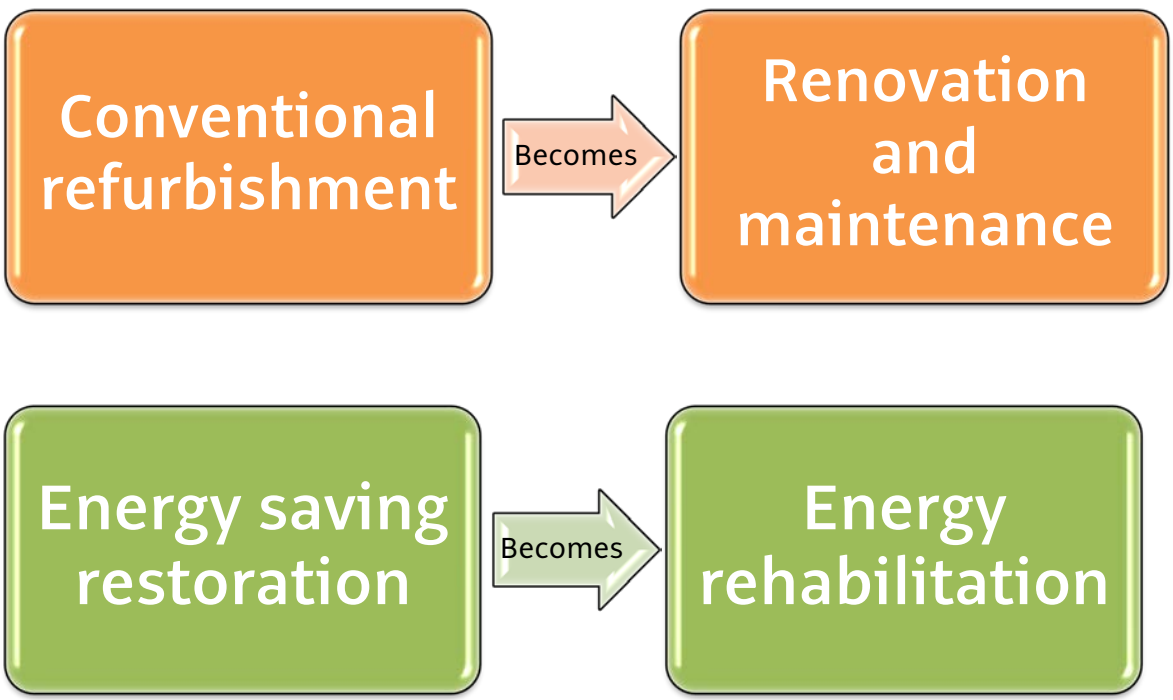


Figure 21. WP2 tasks and activities. Renaming the core concepts

Accordingly, the group deemed necessary to adapt the nomenclature used for denominating each processes defined in the documentary analysis. Also, they proposed some more processes not considered in the first approach.

In this respect, experts proposed the following classification:

Conventional refurbishment	Renovation and maintenance
✓ Modernization of surfaces	✓ Coating and finishing
✓ Previous demolition and internal partition wall	✓ Internal walls demolition
✓ Structural elements	✓ Renovation of structures
✓ Accessibility and elevators	✓ Accessibility
✓ Replacement of windows	✓ ***Goes to energy rehabilitation***
✓ Electric installations	✓ Installations and plumbing
✓ Renovation of bathroom	✓ Renovation of bathrooms
✓ Renovation of kitchens	✓ Renovation of kitchens
✓ Renovation of roofs	✓ Maintenance and renovation of roofs
✓ Renovation of roofs. Non-sloping roofs	
✓ Special field of renovation / modernization	✓ ***It is not the subject of this project***
✓ Replacement of dangerous materials	✓ Replacement of dangerous materials
	✓ Waterproof insulation of drain pipes
	✓ Moistures correction
	✓ Maintenance and renovation of facades
	✓ Internal carpentry

Energy restoration	Energy rehabilitation
✓ Modernization of heating systems	✓ Heating systems
✓ Insulation from outside	✓ Insulation of facades
✓ Insulation of windows	✓ Replacement and insulation of windows
✓ Insulation of roofs	✓ Insulation of roofs
✓ Insulation from inside	✓ Insulation from inside
✓ Air conditioning	✓ Heating and cooling systems
	✓ Hot water

On the subject of key competences, a discussion was held in order to make out a first list regarding mathematical skills and basic competences in science and technology that may be associated with the building processes previously identified.

Mathematical skills
✓ Integer numbers
✓ Trigonometry
✓ Fraction numbers
✓ Real numbers
✓ Geometry
✓ Tolerance
✓ Calculus
✓ Scales
✓ Measurements systems

Basic competences in science and technology
✓ Science and its utility
✓ Scientific knowledge
✓ Physics, Chemistry, Biology
✓ Knowledge regarding installation and assembling of systems
✓ Materials and products properties

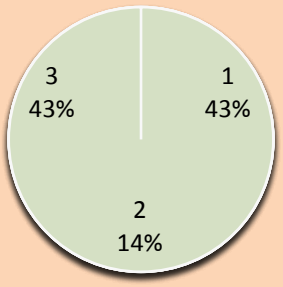
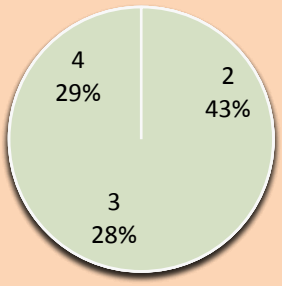
Others competencies
✓ Oral and written communication
✓ Search and information management
✓ Identification and troubleshooting
✓ Intuition
✓ Professional ethic
✓ Collaborative skills

3.3. Italy

The focus group in Italy (Vicenza) was carried out with the participation of the project managers, (which are also technicians in construction sector), one teacher, two trainers and three trainees. During this group, it was applied a questionnaire (annex 1) that had a double aim:

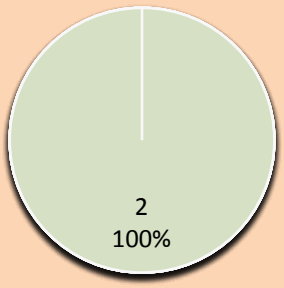
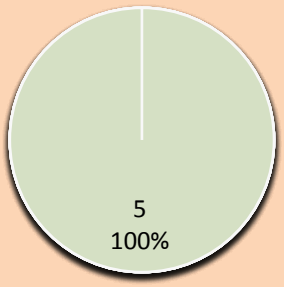
- To assess, validate and therefore reinforce the documentary analysis
- Propose improvements to the documentary analysis

3.3.1. Results

Q1. Is necessary to include new phases or tasks related to the rehabilitation of buildings?	*Q3. Do the proposed processes meet the demands of this emerging sector (rehabilitation)?*
	

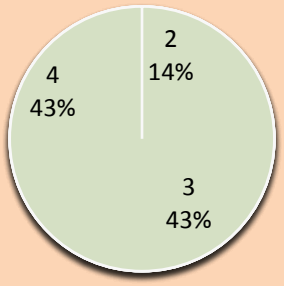
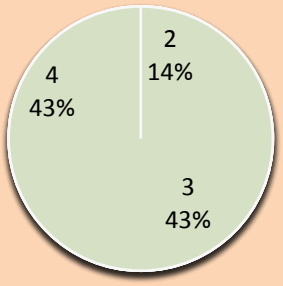
COMMENTS

- ✓ Construction of plaster walls and ceilings for interior renovation
- ✓ Upgrading of the sewage system to the new provisions of the law
- ✓ Resolution of any problems due to upward migration of soil moisture
- ✓ Removal of any thermal bridges

Q4. May consider the relationship between the activities of this construction and specialty trades or jobs with which they are associated?	*Q6. The emergence of professionals whose specific training lead to rehabilitation or any of the specific phases thereof is required?*
	

COMMENTS

- ✓ Modernization of surfaces: plasterer, drywalls layer
- ✓ Structural elements: operator who pours the concrete in the formworks for
- ✓ casting (in Italy he is not the same one that makes the formworks)
- ✓ Renovation of roofs: operator laying waterproofing material / layers
- ✓ Special field of renovation / modernization: restorer for the recovery of
- ✓ old/ancient stones and old wood (for reusing them)

Q7. Please rate the methods or mechanisms for energy saving renovation.	*Q8. Consider, and rate the relationship between the proper techniques and methods proposed and trades or jobs assigned to them*
	

COMMENTS

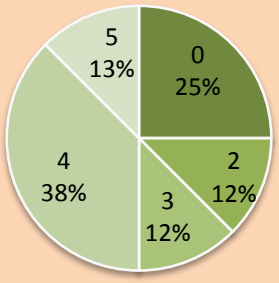
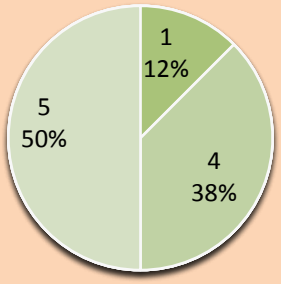
- ✓ Modernization of heating systems:
- ✓ For installation of geothermic systems: soil drilling operator
- ✓ For installation of Biomass heating systems: carpenter, welder and bricklayer (for the deposit of pellets)
- ✓ Air conditioned (probably it would be more correct to use the term "cooling systems"):
  - For installation of geothermic systems: soil drilling operator
  - For installation of domestic wind power systems: welder, crane operator

3.4. Romania

The focus group in Romania (Timisoara) was carried out with the participation of eight stakeholders. During this group, it was applied a questionnaire (annex 1) that had a double aim:

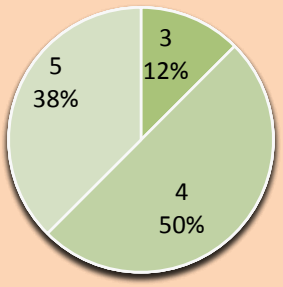
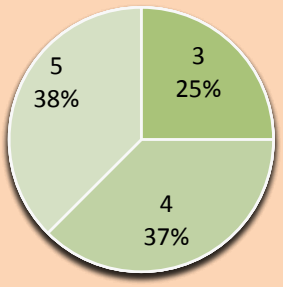
- To assess, validate and therefore reinforce the documentary analysis
- Propose improvements to the documentary analysis

3.4.1. Results

Q1. Is necessary to include new phases or tasks related to the rehabilitation of buildings?	*Q3. Do the proposed processes meet the demands of this emerging sector (rehabilitation)?*
	

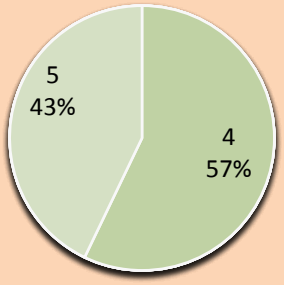
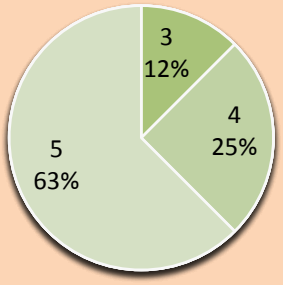
COMMENTS

- ✓ Rehabilitation of stone masonry elements , mosaics, monuments, architectural elements
- ✓ Specialized craftsmen in the rehabilitation of historic buildings construction elements
- ✓ Insulation of pipes
- ✓ Fire protection of building elements, protection from noise

Q4. May consider the relationship between the activities of this construction and specialty trades or jobs with which they are associated?	*Q6. The emergence of professionals whose specific training lead to rehabilitation or any of the specific phases thereof is required?*
	

COMMENTS

- ✓ Specialized craftsmen in the rehabilitation of historic buildings construction elements
- ✓ Restoration of building / buildings of heritage
- ✓ Insulator
- ✓ Fitter of dry elements , fireproof and acoustic laborer
- ✓ Locksmith, mechanic, roofer

Q7. Please rate the methods or mechanisms for energy saving renovation.	*Q8. Consider, and rate the relationship between the proper techniques and methods proposed and trades or jobs assigned to them*
	

COMMENTS

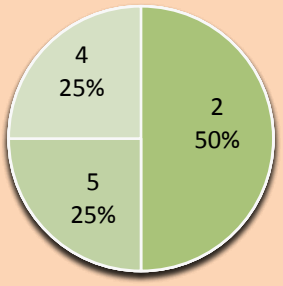
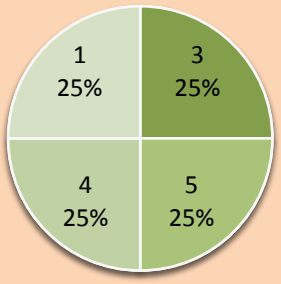
- ✓ Elevator responsible, specialist health and safety
- ✓ Specialized craftsmen in the rehabilitation of historic buildings construction elements
- ✓ Electricians, solar installation specialists
- ✓ Fitter thermal and noise insulation, façade and chimney cleaner

3.5. Portugal

The focus group in Portugal (Lisbon) was carried out with the participation of eight professionals: the project managers, qualified construction workers, trainers, trainees and managers. During this group, it was applied a questionnaire (annex 1) that had a double aim:

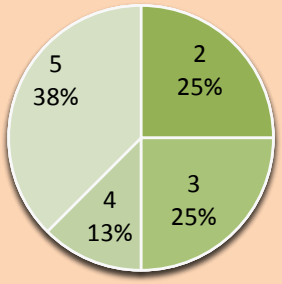
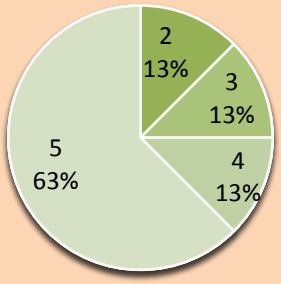
- To assess, validate and therefore reinforce the documentary analysis
- Propose improvements to the documentary analysis

3.5.1. Results

Q1. Is necessary to include new phases or tasks related to the rehabilitation of buildings?	*Q3. Do the proposed processes meet the demands of this emerging sector (rehabilitation)?*
	

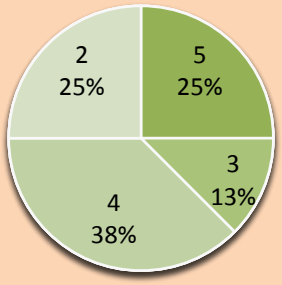
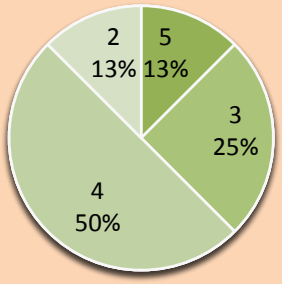
COMMENTS

- ✓ Implementation of new materials and processes appropriate building to optimize existing structures with new techniques and more effective materials.
- ✓ Compatibility studies of material to install compared to the existing one. Use of new materials.
- ✓ Monitoring and control project indications regarding structural elements.

Q4. May consider the relationship between the activities of this construction and specialty trades or jobs with which they are associated?	*Q6. The emergence of professionals whose specific training lead to rehabilitation or any of the specific phases thereof is required?*
	

COMMENTS

- ✓ Especially the structural part. Both in the calculation, as in part of the work involved.
- ✓ Senior technical staff in the areas of electrical engineering and mechanical Architects,
- ✓ Engineers and Real Estate Agents. All specialties as pose have to be used.

Q7. Please rate the methods or mechanisms for energy saving renovation.	*Q8. Consider, and rate the relationship between the proper techniques and methods proposed and trades or jobs assigned to them*
	

COMMENTS

- ✓ Training of applicators of new materials used in the coatings, floors, walls and ceilings.
- ✓ Roof coverings. (Flat and sloping plateaus Thermal, other...)
- ✓ Coat of exterior facades ... (ventilated facades)
- ✓ Using frames / glasses with other type of behavior.
- ✓ Thermal and acoustic insulation.
- ✓ Electricians and electronic technicians / home automation.
- ✓ Control and use of water / rain ... others.
- ✓ Regarding vocational framework, the specializations are defined. As the lifelong learning, tracking the evolution of materials, techniques and construction processes the great solution for the sector.

4.Final perimeter

4.1. Introduction

During the 2nd steering meeting that took place in Rome the 7th and 8th of May, project team agreed a final perimeter of refurbishment processes that would be considered within the project, taking into account the results coming from the different focus group carried out in each country. Also, during this encounter the partnership defined the specific tasks related to each processes.

4.2. Perimeter

Renovation and maintenance processes	Tasks that will be addressed
Coating and finishing	Plastering
	Painting
	Floor laying
	Tiling
Internal walls demolition	Collecting materials
Renovation of structures	Bricklaying
	Stabilize de structure
Renovation of bathrooms	Floor laying
	Tiling
	Sanitary installation (levelling, supports, etc)
Waterproof insulation of drain pipes	Dimensioning the pipes
	Material for joining
	Installation of supports
Installations and plumbing	Laying pipes
	Laying wires
Moistures correction	Painting
Accessibility	Ramps
Maintenance and renovation of roofs	Laying tiles
	Preparing the base for tiling
	Waterproofing
Maintenance and renovation of facades	Check the surface
	Remove the old one
	Painting
Internal carpentry	Remove the old door
	Preparing the sub-frame

Final perimeter

Energy rehabilitation	Tasks that will be addressed
Heating systems	Pipes distribution
	Supports for system
	Chimney
Hot water	Pipes distribution
Replacement of windows	Remove the old ones
	Preparing sub-frame for the new ones
Insulation of roofs	Waterproofing
	Insulation
Insulation of facades	Laying the panels
Air-conditioning (heating/cooling)	Pre-installation of the system

The *"tasks that will be addressed"* mean that the training system will use these tasks as a basic example for teaching trainees key competences. Of course, the difficulty or deepness of these tasks will be adapted taking into account that the main target group are unskilled workers from the building industry. In this regard, the following common tasks will be considered:

Common tasks
Opening channels on walls
Preparing of pastes and mortars grip
Site layout
Application of coverings
Preparing of sub-frame for doors
Preparation of openings for windows
Cutting of ceramic pieces
Use of hand tools
Handling of loads manually
Mounting of supports for installations
Preparing the surface for coating
Placing of insulation material

5.ANNEXES

ANNEX 1. Assessment questionnaire

Taking in account the contents proposal set up in the Documentary Analysis please answer the following questions, by choosing an option between 0-5 (0 for low agreement and 5 for maximum agreement):

Q1. Is necessary to include new phases or tasks related to the rehabilitation of buildings?

☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q2. If your answer in the previous question was 3, 4 or 5, please, write them:

Q3. Do the proposed processes meet the demands of this emerging sector (rehabilitation)?

☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q4. May you consider the relationship between the activities of this construction and specialty trades or jobs with which they are associated?

☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q5. What other professionals in the construction sector may you proposed?

Q6. The emergence of professionals whose specific training lead to rehabilitation or any of the specific phases thereof is required?

☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q7. Please rate the methods or mechanisms for energy savings and use of the criteria proposed in paragraph 3.2 (Energy Saving Renovation).

☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q8. Consider, and rate the relationship between the proper techniques and methods proposed and trades or jobs assigned to them (paragraph 3.2).

☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Q9. What other professionals in the construction sector could be proposed.

ANNEX 2. Focus group guideline

A guideline is needed to order better the discussion and subsequent analysis. Anyhow, the moderator should try to assure as much as possible the free intervention of the participants. The topics that must be addressed are the following ones:

- ✓ Individual presentation of each participant. Short introduction about their professional activity, education, background, and the like.
- ✓ AR.KEY project overall presentation.
- ✓ Presentation regarding commonest refurbishment processes set up in the documentary analysis.
- ✓ Taking into account the proposed processes, fill in the questionnaire along with the participants.
- ✓ Joint discussion regarding the proposed processes in order to make suggestions and improvements to the first proposal.
- ✓ First discussion in order to start the connection between processes and key competencies.
- ✓ Wrap up, conclusions and end of the session.

ANNEX 3. Figures list

Promoter of the Project:

FUNDACIÓN LABORAL DE LA CONSTRUCCIÓN
SPAIN

Partners of the Project:

CENTRO EDILE ANDREA PALLADIO
ITALY

ENTE NAZIONALE PER L'ADDESTRAMENTO PROFESSIONALE NELL'EDILIZIA (FORMEDIL)
ITALY

CENTRO DE FORMAÇÃO PROFISSIONAL DA INDÚSTRIA DA CONSTRUÇÃO CIVIL E OBRAS PÚBLICAS DO SUL (CENFIC)
PORTUGAL

FUNDAȚIA ROMÂNO-GERMANĂ TIMISOARA (FRG)
ROMANIA

INSTITUT UNIVERSITARI D´INVESTIGACIÓ DE ROBÒTICA I TECNOLOGIES DE LA INFORMACIÓ I COMUNICACIÓ (IRTIC)
SPAIN

BILDUNGSZENTREN DES BAUGEWERBES E.V (BZB)
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