BIMplement

Towards a learning building sector by setting up a large-scale and flexible qualification methodology integrating technical, cross-craft and BIM related skills and competences.

www.bimplement-project.eu

Report:	D2.3 Adjusted methodology for a BIM-enhanced Qualification Framework including an instruction guide
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Date:	2018-1-31 , update on the version of 2018-9-28
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1. Introduction/summary

Objective of BIMplement workpackage 2 was to develop a BIM-enhanced Qualification Framework empowering nZEB construction and renovation. In this deliverable the developed and (in workpackage 3) tested and adapted method for developing BIMplement Qualifications is documented. This including a basic instruction guide for application of the final version of the methodology.

The initial version of the methodology is developed in three iterations during T2.1 'Drafting the methodology'. In tasks T2.2 and T3.1. the result has been applied and validated in dialog with National stakeholders in Poland, France, the Netherlands, Lithuania and Spain. During T2.2 and T3.1 several additional improvement iterations have been made. As last step in T2.3 the methodology is finalised and documented in a short userguide.

The BIM-enhanced Qualification Framework is stored in Excel and will be added to an easy to use normalized database provided by ISSO (in cooperation with BuildUpSkillsNL and H2020 Newcom) in order to be provided to/in a digital taxonomy tool BIMaxon. The database and BIMaxon are both on request accessible by API (application programming interface) to enable access for BIM-tools.

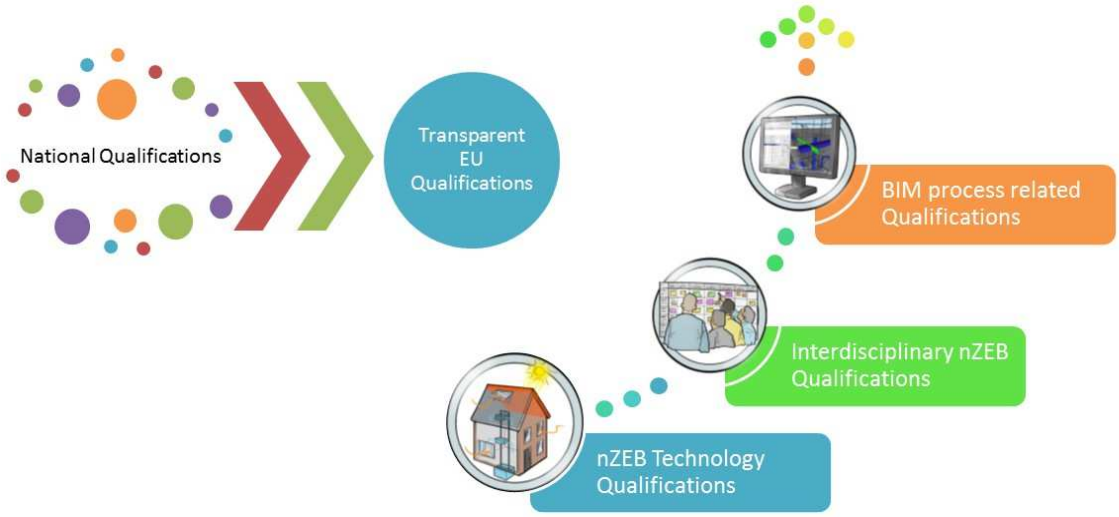
	Accounts to the QF-database can be requested at ISSO by Jan Cromwijk (j.cromwijk@isso.nl)

In this deliverable after a short introduction to the BIMplement Qualification Framework the results of the development iterations are documented. Then the databases usable for development and storage are presented. The deliverable concludes with a step-by-step userguide for actual use.

Introduction to the BIMplement Qualification Framework

The BIMplement Qualification Framework consists of a flexible methodology that allows definition of professional activities, related skills, required competences in order to achieve a desired quality in the field of nZEB. It is setup as a set of re-usable classifications. These classifications can be used in BIM-projects to describe items in a standardized, unified way and to link them to existing classifications that describe involved technologies, project-stages and involved actors.

The BIMplement qualification framework is in other words setup as a *multilayered qualification matrix*. It is composed out of tasks that have to be performed to be effective. It consists of a layer with basic tasks and one or more layers of context specific layers. For example nZEB related tasks, BIM-related tasks. If needed more layers can be added, for example for Indoor air quality (IAQ) tasks or Circulair Buidling tasks.



01 Example of several possible layers of classifcations

2. List of acronyms and abbreviations

Abbreviation	Meaning
Ad	Associate degree
Ba	Bachelor
BIM	Building Information Model
CPD	Continuing Professional Development
ECTS	the European Credit Transfer and Accumulation System
EHEA	Qualifications Framework of the European Higher Education Area
EQF	European Qualification Format
EQF-IP	EQF intake level for the educational or training program
EQF-OP	EQF output level for the educational or training program
IAQ	Indoor air Quality
ISO/IEC 81346	International Standard 81346, published jointly by IEC and ISO defines classes and subclasses of objects based on a purpose- or task-related view of the objects, together with their associated letter codes to be used in reference designations
ISCO-08	The International Standard Classification of Occupations (ISCO) is an International Labour Organization (ILO) classification structure for organizing information on labour and jobs.
IN	Initial education
Ma	Master
PhD	Doctor of philosophy / Doctorate
PI	Post initial education
nZEB	Nearly Zero Energy Building
ULO	Unit of Learning Outcome

3. Definitions

Term	Meaning
Accreditation	Accreditation is a quality assurance process under which services and operations of (educational) institutions or programs are evaluated by an external body to determine if applicable standards are met. If standards are met, accredited status is granted by the appropriate agency. (*Wikipedia*)
BIM-axon	BIMAXON is a human-readable classification of BIM element properties. That would facilitate communication, help fill in gaps in the BIM process, and make it easier for every actor to obtain and understand the information that they need at any given moment. It is based on BIM uses and the needs of specific BIM actors, to ensure that deliverables are right for every drop point and to provide just the right set of information to each actor at every moment.
Building stages & RIBA	A building life-cycle consists of several stages. The RIBA Plan of Work is the definitive UK model for the building design and construction process.
Competence	The ability of an individual/organisation to do something effectively. It consists of a cluster of related abilities, commitments, knowledge, and skills that enable a person (or an organization) to act effectively in a job or situation.
Initial education	Training people receive before entering the labour market. In general, initial education is based on qualification documents and corresponding professional competency profiles. These qualification documents are drawn up nationally by the knowledge centres of the various professional sectors. Completing initial education results in the earning of a certain EQF level and a diploma, which has an unlimited validity.
Multilayered qualification	A multilayered qualification is a description of tasks that have to be performed to be effective. It consists of a layer with basic tasks and one or more layers of context specific layers. For example nZEB related tasks, BIM-related tasks or Indoor air quality (IAQ) tasks.
Occupation	An occupation is a a job or profession
Post-initial training	Training people receive after leaving initial training. In general, professional post-initial training is based on demand from market parties for retraining. These (short) trainings results most times in a certificate, which offers a limited validity. They do not result in the earning of a certain EQF level.
Profession	A profession is a specialized occupation characterized by profession specific education and training.
Qualification	A pass of an examination or an official completion of a course, especially one conferring status as a recognized practitioner of a profession or activity.
Qualification document	A qualification file describes what a participant in education should know and master at the end of a (intermediate vocational training) course. A qualification file describes the level of starting professional workers (school leavers).
Qualification structure	A formal system describing qualifications It makes visible which qualifications or sets of competences are sought by the labour market, education and society to secure a job, start further studies or participate in society.

<table>
<tr><th>Term</th><th>Meaning</th></tr>
<tr><td>Skill</td><td>The ability to do something well; expertise</td></tr>
<tr><td>Skill-level</td><td>
<table>
<tr><td>0</td><td>Not applicable / no knowledge and skills required</td></tr>
<tr><td>1</td><td>Has little knowledge and skills with respect to the relevant field / technology (mostly outside the own field of expertise). Understands basic principles and is able to take part in project team discussions.</td></tr>
<tr><td>2</td><td>Understands basic knowledge and has practical skills within the field / technology, is able to solve simple problems by selecting and applying basic methods, tools, materials and information (mostly outside the own field of expertise).</td></tr>
<tr><td>3</td><td>Has comprehensive, factual and theoretical knowledge and skills within the field / technology, is capable of solving standard problems within the field.</td></tr>
<tr><td>4</td><td>Has advanced knowledge involving a critical understanding of theories and principles and skills, required to solve complex and unpredictable problems in the field and is aware of the boundaries.</td></tr>
<tr><td>5</td><td>Has specialized knowledge and problem-solving skills, partly at the forefront of knowledge in the field, in order to develop new knowledge and procedures and to integrate knowledge from different fields.</td></tr>
</table>
</td></tr>
<tr><td>Unit of Learning Outcome as stated during EU-Exchange of BUILD UP Skills projects</td><td>A Unit of Learning Outcome
1. ‘knowledge’ is the body of facts, principles, theories and practices that is related to a field of work or study
2. ‘skills’ means the ability to use know-how to complete tasks and solve problems, and they can be cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments)
3. ‘competence’ is the capacity to apply, in daily work, the knowledge and skill, i.e. someone knows how to do a task besides knowing the theory.

Competence addresses ‘responsibility and autonomy’ it is the ability of the learner to apply knowledge and skills autonomously and with responsibility.

Source: TWG 2 Mutual recognition of skills and qualifications
http://www.buildup.eu/en/skills/twg-2-mutual-recognition-skills-and-qualifications
Available at
http://www.buildup.eu/sites/default/files/bus_document_twg/twg2_final_deliverable_report_revised.pdf</td></tr>
<tr><td>Definitions stated by the EU</td><td>These definitions are cited from the Council recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning.

‘learning outcomes’ means statements regarding what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and responsibility and autonomy;

‘knowledge’ means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the EQF, knowledge is described as theoretical and/or factual;

‘skills’ means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments);
‘responsibility and autonomy’ means the ability of the learner to apply knowledge and skills autonomously and with responsibility;</td></tr>
</table>

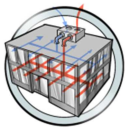
	'competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development; Source: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.C_.2017.189.01.0015.01.ENG&toc=OJ:C:2017:189:FULL
Specialism	A technology or application of several combined technologies specific set of tasks
Task	A piece of work to be done or undertaken.
Taxonomy	A taxonomy defines classes of objects and relations among them
Training Scheme	A scheme for teaching people skills in a particular field or profession
Trias Energetica	A concept that is based on 3 steps: First, we need to limit energy demand through energy saving. Second, renewable sources should be used to meet the remaining energy demand. Only as last step fossil fuels should be used, as efficiently and cleanly as possible.

4. Summary of the development process

Kick-0ff

During the Kickoff-meeting in Paris (12 - 13 October 2017) a generic outline of the BIM enhanced Qualifcation Framework has been presented and discussed. This qualification framework outline is based on PROF/TRAC outcomes (website link) and serves as a quickstart for further BIMplement work.

nZEB Specialisms | **Professions/occupations involved**



Heatpumps

Short description of the specialism

Type of	Proces-Phase	Tasks related	Classification	Architect	E-Engineer	M-Engineer	B-Engineer	Proces manager	Bricklayer	Carpenter	E-installer	M-insstaller
Water-water	Programme	Task 1	nZEB	x				x				
		Task 2	Interdisciplinary	x	x	x	x					
		Task 3	BIM									
		Task n										
	Design											
	Elaboration											
	Realisation											
	Operation											
	Maintenance											
Water-air	Programme											
	Design											
	Elaboration											
	Realisation											
	Operation											
	Maintenance											
Air-Air	Programme											
	Design											
	Elaboration											
	Realisation											
	Operation											
	Maintenance											

02 Generic qualification framework outline based on PROF/TRAC

After the kick-off meeting the generic outline has evolved in three iterations.

Iteration I

For this iteration ISSO worked out a small number of professional activities within the PROF/TRAC Qualification Excel-format, related to the specialism Ventilation of residential buildings. After discussion the results were extended by:

- Exploring the possibility to store the Qualification as a set of Classifications in BIMaxon. BIMaxon is a tool for creating and linking Classifications to BIM-models. Working with this tool makes it possible to work with existing BIM classifications such as ISO/IEC 81346
- The list of involved professions is extended both with several blue and white collar professions

nZEB Specialisms					Workfields involved												
Ventilation of homes	A ventilation system is necessary to guarantee fresh indoor air climate. The energy use of this system is very much dependent of the type of system, and the quality of engineering and construction. The types addressed are: mechanic ventilation, decentral ventilation and balanced ventilation.				Architecture	Structural engineering	Mechanical Engineering	Electrical engineering	Construction management	Building management	Financing and procurement	Bricklayer	Carpenter	E-installer	M-installer	Concrete/masan borer
	Type of	**Proces-Phase**	**Tasks**	**Subtasks**												
	Decentral	Programme														
		Design														
			Make an air balance for the building				X									
				Determine ventilation requirement per room			X									
				Determine airflow rate from one room to another			X									
				Divide flow rate(s) over suction points			X									
				Determine percentage of outside air for each room			X									
		Elaboration														
		Realisation														
			Installation of a local balanced												X	

03 Result of the first iteration

Iteration II

In the second iteration classifications used in BIMAXON were applied within the BIMplement Qualifications and some additional BIMplement classifications have been proposed. This was done to find out if we can work out the BIMplement Qualifications as a set of re-usable classifications. With as result a multilayered qualification. The results of this iteration has been used to reformat and extend the results of the first iteration.

> *The result is not a 3-dimensional matrix, but a multilayered qualification*
> *"referring to multi-layers (for the qualification scheme) is better than multidimensional as in BIM terminology multidimensional data refers to 3D model, 4D including time and 5D costs…"*

An example of the use of classifications to build up the multilayered qualification

Technology **Ss Systems - 30 July 2017 - v1.7**
- Ss_65_40_33_? Decentral balanced ventilation system

Main task / Main activity
- Installation

When: (BIMAXON-STAGES)
S5 STAGE 5: Construction (extra activities needed to ensure protection of the installed system)
S7 STAGE 7: In Use (extra activities needed for ensuring minimal dust-release)

Sub-task / Sub activity **BIMplement taxonomy**
SIT = Self Inspection Task
BIT = BIM task from BIM USES - BIMAXON taxonomy
WOT = Work Task from BIMplement taxonomy

Example of a result of the second iteration

1. **BIT** CL Field / manage tracking Check if this is the right moment in the planning
2. **BIT** CD Safety planning Check if safety measures are in place
3. **WOT** Create wall passages for supply and exhaust air
    a. Determine the location where the system must be mounted
        i. check how many connections have to made to the system (supplier documentation)
        ii. determine the needed space for the system (supplier documentation)
        iii. determine stiffness of the wall (= a separately stored task)
        iv. **BIM SIT** check if there are cables or tubes in the wall (= a separately stored task)
    b. Mount the drilling template (= a separately stored task)
        i. **SIT** Check with Augmented Reality measuring if the drilling template is place correct
    c. Drill needed holes :Ø 300 – 350 mm in the wall (= a separately stored task)
4. **WOT** Install ducts in the wall (air and water tight)
    d. Realize air- and water-tightness (= a separately stored task)
        i. **SIT** Make photo's between the steps that have to be performed to realize air- and water- tightness
        ii. **SIT** Measure the airtightness with a Sound-brush

Basic Task: check if there are cables or tubes in a wall

K1: what to know (there can be existing cables or tubes in a wall)
K2: what to understand (drilling through existing cables or tubes can be risky & costly)
K3: what activities to be able to
1. use a wire/tube finder (=separately stored task)
2. read a drawing (=separately stored task)

Specific Task: Mount / install a decentral balanced ventilation unit

K1: what to know (the used of vibration dampers and flexible connections to connect unit and ductwork)
K2: what to understand
K3: what activities to be able to

Iteriation III

The third iteration was split into two parts. First a worksession on 28th of November 2017 and second a discussion of results on the 12th of December 2017.

For the worksession on the 28th of November 2017 a proposal for 'professions and occupations names and codes in BIMplement' was written and the results of the second iteration where worked out in more detail. This overview based on ISCO-08 can be found in Annex II.

Within Work Tasks it was decided to make a distinction between 'Basic tasks' and 'Specific tasks'
- Basic tasks are part of the regular education of a worker
- Specific tasks are nZEB or product or technology related

Focus in BIMplement will be on detailing the Specific tasks and the BIM tasks.

To do this the following structure was proposed in the worksession of Nov 28:

BIMplement (Task classes)
BAS Basic task (do not detail them)
BIT BIM task (empowering the work to be done (more efficient) (WP2 &3 content)
QUT Quality Task (including basics, nZEB-quality & self-inspection) (total quality)

In the December 12 meeting it was further optimized to:
BIMplement (Task classes) for subtasks
BAS Basic task (we do not detail these tasks, they are only mentioned)

nZT nZEB Task (all tasks concerning application of nZEB technologies)
BIT BIM task (all tasks to BIM empower the work to be done (more efficient))
Aspects of quality control are integrated into the task descriptions

When it comes to the actual work to be performed by craftsmen a set of BIMplement Tasks Classes has been proposed, consisting of:

a. Preparation
b. Installation
c. Finishing

This proposal has not been applied, due to the high amount of details needed.

Based on the final discussion on the 12th of December 2017 ISSO aggregated all the results into one final outcome of the exercises done while developing the methodology. This can final outcome be found in Annex I

Illustrative result of the second iteration

BIMplement (Task classes) for subtasks
BAS Basic task (we do not detail these tasks, they are only mentioned)
BIT BIM task (all tasks to BIM empower the work to be done (more efficient))
nZT nZEB Task (all tasks concerning application of nZEB technologies)
Aspects of quality control are integrated into the task descriptions

S5 STAGE 5: Construction

1. Field / manage tracking Check if this is the right moment in the planning
2. Safety planning Check if safety measures are in place
3. Create wall passages for supply and exhaust air
    e. Determine the location where the system must be mounted
        i. check how many connections have to made to the system (supplier documentation)
        ii. determine the needed space for the system (supplier documentation)
        iii. determine stiffness of the wall
        iv. check if there are cables or tubes in the wall
    f. Mount the drilling template
        i. Check with Augmented Reality measuring if the drilling template is place correct
    g. Drill needed holes :Ø 300 – 350 mm in the wall
4. Install ducts in the wall (air and water tight)
    h. Realize air- and water-tightness
        i. Make photo's between the steps that have to be performed to realize air- and water- tightness
        ii. Measure the airtightness with a Sound-brush

5. Summary of the testing proces

In Task 3.1, extensive testing and implementation of the QF is done for two important areas in nZEB (air-tightness and ventilation) to see that the methodology works and results in a useful description of the activities, skills and competences for all professions through all the building stages. This application led to four more development iterations.

Iteriation IV

In the first iteration the in WP2 developed methodology was extended with a short instruction guide (Annex IV) and applied by the involved project partners.

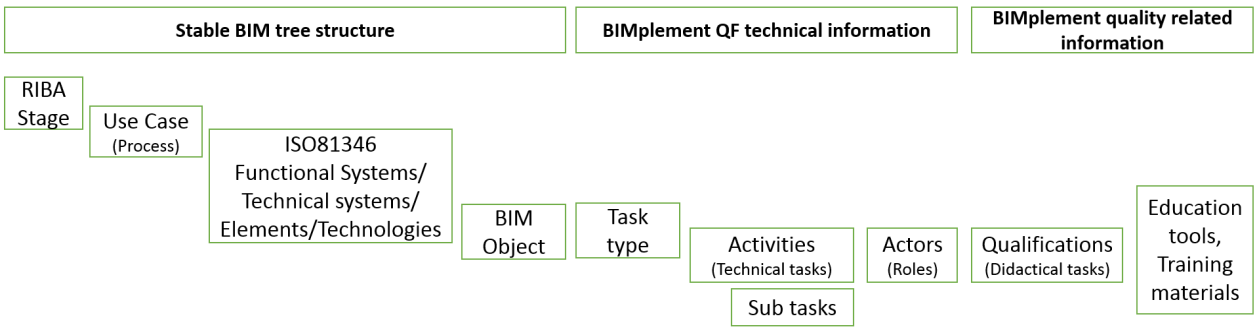
Based on the results a small additional guiding document was written with more background on the development of Unit of Learning Outcomes (Annex V).

Discussed was how to connect the results in a fast and easy way to BIMaxon. To facilitate this an addition to the tables was made.

Relevant technology (according to ISO 81346)	Project stage	BIM object	Task	Actors	Subtask	Code	Task class
JJ-Ventilation system	S5	Warning sign	Instructions read out	Installer of the ventilation system	Read the instructions	JJ-S5-0	BAS
	S5	Every component is link	Check the delivery	Installer of the ventilation system	Check the delivery with regard to completeness and perfect condition!	JJ-S5-1-1	BAS
Decentralized Ventilation System with Heat Recovery Type e² mini	S5	Tube and outer grill	Assembly Tube and Outer Grille	Installer of the ventilation system	Prepare wall cavities for the assembly tube	JJ-S5-1-1	BAS
http://www.lunos.lt/sites/	S5	Tube and outer grill		Installer of the ventilation system	Insert the tube and seal it all round	JJ-S5-1-2	BAS

Iteriation V

The in Iteration IV proposed way of connecting easily to BIM-axon happens to be to easy. Therfor the Lithuanian partners proposed to work with a BIM structure based on the ISO81346.



04 BIMplement QF structure

In this version of the BIMplement QF structure a split has been made between:

1. the BIM-tree structure
2. the technical information about tasks, subtasks and actors
3. the Unit of learning outcomes and related education tools and training materials.

STABLE BIMplement structure								
	LEVEL I		LEVEL II		LEVEL III			
Project stage	**ISO 81346 Functional system class**	**Functional system name**	**ISO 81346 Technical system class**	**Technical system name**	**ISO 81346 BIM object class**	**BIM object name**	**Task code**	**Task name**
	JJ	**Ventilation system**						
	JJ		HF	**Decentralized ventilation system**				
	JJ		HF					
	JJ		HF					
S3	JJ		HF				1	Choose appropriate components based on the available market products from different manufacturers
S3	JJ		HF				2	Determine the number of devices needed to provide the needed capacity
S3	JJ		HF				3	Determine the locations of the decentralized ventilation units
S3	JJ		HF				3	
S3	JJ		HF				3	
					GQA	**Ventilation grille**		
S3	JJ		HF		GQA		4	Determine the type of the ventilation grille

05 Stable BIM structure

Task name	SUB-task code	SUB-task name	BIMplemen	Actors (Job title or sugge	K1: List of what to know (knowledge)	K2: List of what to understand (skill)	K3: List of what to be able to do (competence)
Ensure and Integrate in the project the level of air-tightness to be obtained							
	a	Set air-tightness level	nZT	Architect (Building arquitect according to ISCO-08)	national regulations about energy performance of buildings included air-tightness conditions	understand the importance of air-tightness and the influence of air leakages in the energy performance of the building	set air-tightness level for the specific project
	b	Determine the position of the air-tightness layer identifying the boundary limits of the building air barriers and of the zone or zones to be controlled and tested for air leakage	nZT	Architect (Building arquitect according to ISCO-08)	what air-tightness means and its influence in other aspects such as condensations	understand the importance of air-tightness and the influence of air leakages in the energy performance of the building	create an optimal developed design of the building being able to consider those
	c	Avoid breaking the air-tightness layer: minimum penetrations	nZT	Architect (Building arquitect according to ISCO-08)	what breaking the air-tightness layer means: penetrations or joints	understand that breaking the air-tightness layer generates air leakage that affects the energy performance of the building	create an optimal design avoiding breaking the air-tightness layer
	d	Try to minimize the length of joints in the design	nZT	Architect (Building arquitect according to ISCO-08)	what is a joint?	understand that minimize the lenght of joints minimize the air leakages	create an optimal design minimizing the lenght of joints
	e	Intregate this data in the BIM model	BIT	BIM engineer / BIM arquitect	what is a BIM model?	Understand how to use BIM as a tool to integrate the airtighness level set	Integrate the data and share it with other relevant project management stakeholders (HVAC systems)
Introduce BIM request in the project							
	a		BIT	architect/project manager	know what is a BIM model (compared to a 3-D model)	Understand how to use BIM as a tool to obtain the specified airtighness level	draft precise specifications for the projet management stakeholders (structural eng.)
Specify the level of precision of the BIM model							
	a		BIT	architect/project manager	know what means/is LOD level in a BIM model	difference between 3-D model and BIM model	use specific BIM software
						the different type of data, and importance of data	introduce BIM data in the model

06 Technical information and the ULO's

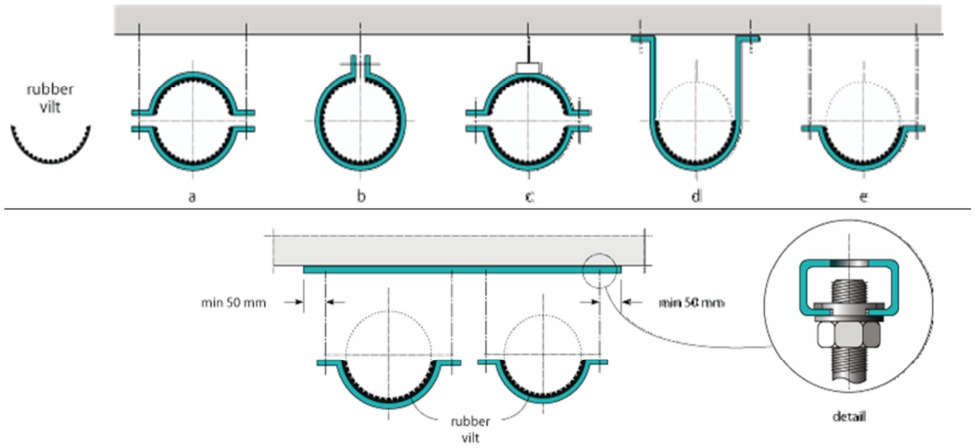
actual information needed / input	result or output of calculation(s)	Quality checkpoint	National regulations (standards)	Relevant education material (guidelines, manual)	Associated BIM based learning tools, help	Suggested training course (available national trainings)	Additional references and notes
expected use of the room	for each room the position of air supply and discharge fixed	at least 0,3 m from a wall/ceiling or corner					
schedule of requirements	type of ventilation system is fixed						
schedule of requirements and requested energy performance	number and type of sensors has been determined		eneergy performance, building decree				
presence installation technical room and/or vailable space	location of the ventilation unit(s) is determined	weight of the wall / floor at least 200 kg/m^2 and preferably in a separate (installation) space					
map / technical drawings of building	global layout of ducting system has been determined						
needed airflows in the rooms and which walls are fire-separating walls							
needed airflows in the rooms and which walls are fire-separating walls	number and location(s) of check valves determined		Building decree				

07 Quality information and links to training tools and materials

Iteriation VI

In this iteration we got stuck in implementation complexity.

1. For airtightness the question arised on how to add information on airtightness to the BIM-model? Possible solutions mentioned:
    1. Openings are also objects in the BIM-model, so we can link this information to the openings.
    2. Add the airtightness to the products involved. But than choices have to be made. Do you add it for example to the duct or to the wall / to the windown or to the wall. To increase complexity, many times the airtightness is realized multiple products in a specific sequence. To tackle this it is proposed to work with so called reference building or installation details in which using 2D drawings or a 3D step-by-step instruction the application is visualized in detail, together with some instruction for workers.



This is not tackled in the Qualification framework, but in the 'instruction materials'

2. Till stage 2 no BIM-model = available, where to link with the Qualification?
3. Another question that rised was how to guarantee the availability if BIMplement QF linked information when working with IFC-viewers?

4. For ventilation technology there where a lot of differences, but also duplications based on the specific type of ventilation and operation modes available.

Project stage	Market-type	natural supply and natural exhaust (system A)	mechanical supply and natural exhaust (system B)	natural supply and mechanical exhaust (system C)	natural supply and mechanical exhaust in every room (system C4c)	mechanical supply and mechanical exhaust , central unit (system D)	decentral mechanical supply and mechanical central exhaust	one or two rooms with decentrally blanced system and system C in rest of dwelling (system E)	Manual operation	operation by time switch	presence detection	relative humidity sensor	CO2-sensor	TVOC-sensor	Structural construction system
S1	general	X	X	X	X	X	X	X	X	X	X	X	X	X	
S1	general	X	X	X	X	X	X	X	X	X	X	X	X	X	
S1	general	X	X	X	X	X	X	X	X	X	X	X	X	X	

08 Colums added in a trial to tackle differences between types of ventilation systems

Decided was not to tackle all these questions directly but to tackle them during the experiments that have to be prepared in the fieldlabs of WP4. This also in relation to the needs of the experimental sites to be determined in WP4.

Therefor the work done in Task 3.1 was consolidated in two Excel files. One on ventilation and the other on airtightness.

Iteration VII

The seventh iteration did not take place in BIMplement but in the H2020 NEWCOM project (754148). ISSO proposed in the NEWCOM project to start with the final structure of the fifth BIMplement interation, focusing on the following core structure (in NEWCOM connecting to the BIM-model is not within the scope).

Dimension 1	Dimension 2	Dimension 3a	Dimension 3b	Dimension 3c	Dimension 3d	Dimension 3e	Dimension 4		
RIBA-stages	Main tasks	Subtasks identied	Competence Type	Knowledge involved	Skills involved	Competence involved	Occupations involved		
S0-S7	On overall level	On sub-task level	On sub-task level	(items separated with ';')	(items separated with ';')	(items separated with ';')			
S5-Construction	Task 1								
		Subtask 1.1	Basic task	Knowlegde Subtask 1.1	Skills Subtask 1.1	Competence Subtask 1.1		X	
		Subtask 1.2	nZEB task	Knowledge Subtask 1.2	Skills Subtask 1.2	Competence Subtask 1.2			X

09 The fields of BIMplement that where used also in NEWCOM

During the work in NEWCOM it was realized that the biggest problem if the proposed structure was the way of hierarchical structuring. Due to this duplications of in tasks, subtasks and the ULO's where occurring time after time. As a solution the structure was re-structured into a more relational format consisting of a table with tasks and subtasks and a table with Unit of Learning Outcomes.

Project phase	Tasks	Sub-tasks	ULO Nr.
execution fase	**Making holes in wall(s) and/or floor(s)**		
		check/mark position and dimensions of the recess in the wall	12.1
		make the recess or correct the sizes if necessary	12.2
	Install air ducts		
		construct the duct system (supply and discharge)	13.1
		fix ducts in floors against flooding	13.2
		apply adjoining screed / finishing passages in walls	13.3
		install supply valves on the ducting with preset flow rates	13.4
		connect ducts airtight	13.5

10 A table with tasks and subtasks

ULOs for the NZEB Ventilation					
Nr.	Fields of knowledge /Course	Knowledge	Skills	Competentence	Actor
12.2	ho wa	knowledge of making holes in walls/floors	drilling techniques	necessary	Constructor
13.1	installing ducts	knowledge of airtight of connecting ducts	know how to make airtight connections and the difference between the types of ducts	constructing a duct system	Installer
13.2		knowledge of fixing ducts against flooding	know how to fix ducts against flooding	fix ducts in floors against flooding	Constructor
13.3		knowledge of measures during pouring concrete of floorslab	know how to pour the concrete	produce the adjoining screed / finishing passages in walls	Constructor
13.4		knowledge installing supply valves and preset them	influence of valve on airflows in rooms and influence of air speed on comfort	set up and mount supply valves	Installer
13.5		knowledge of making airtight connections in ducts	necassaty of airtight connections	make airtight connections	Installer
13.6		knowledge installing exhaust valves and preset them	influence of valve on airflows in rooms and influence of air speed on comfort	set up and mount valve	Installer
14.1	Mount centrally ventilation unit	knowledge of vibration-free assembly of units	describe the mounting of the ventilation unit	mounting the ventilation unit	Installer
14.2		knowledge of airtight of connecting ducts	know how to make airtight connections and the difference between the types of ducts	connecting the ventilation unit to the duct system	Installer
14.3		knowledge of waste water systems	know how to connect the unit to the waste water system	system	Installer / adjust expert
14.4		knowledge of airtight connecting ducts	know how to make airtight connections and the difference between the types of ducts	assembling silencers between unit and duct system	Installer
14.5		vapor-tight insulation	insulating air ducts and know when and how to do so vapor-tight	isolating channels from the outside to the unit in systems with heat recovery	Installer / isolator
14.6		knowledge of building decree regarding electricity	making a safe and reliable power supply and/or data communication	construct facilities such as electricity and data cables	installer / electrician

11 A table with Unit of Learning Outcomes

Based on these experiences after the BIMplement meeting in Warshaw the QF for airtightness also is restructured.

6. Instructionguide and QF-database

Short instructionguide for developing a task based Qualification

The developed QF-database leads you through these steps. This in order to have as result a fully normalized database without double items with the same meaning.

Step 1: make a list of tasks to be performed & by whom. Describe them as a plain task

Step 1	
An overview of tasks	Actor(s) involved
Task 1…	
Task 2…	
Task 3…	
Use a 'verb' in the tasks to make them active	

For more information about development of sound ULO's and task definitions you can access the following sources:

1. St Edward's University, Centre for Teaching Excellence (2004). Task-oriented question construction wheel, based on Bloom's taxonomy. Available at http://www.stedwards.edu/cte/files/BloomPolygon.pdf
2. University of Arkansas https://tips.uark.edu/blooms-taxonomy-verb-chart/
3. University of Arkansas https://tips.uark.edu/using-blooms-taxonomy/

Step 2: define the relevant 'sub-tasks to be performed' & by whom

Step 2	
An overview of subtasks	Actor(s) involved
Task 1…	
Sub Task 1.1…	
Sub Task 1.2…	
Task 2…	
Use a 'verb' in the tasks to make them active	

Step 3: give each subtask a taxonomy code Basic task, nZEB task or BIM task

BAS Basic task (we do not detail these tasks, they are only mentioned)

nZT nZEB Task (all tasks concerning application of nZEB technologies)

BIT BIM task (all tasks to BIM empower the work to be done (more efficient))

Step 3
Competence Type on sub-task level
Sub Task 1.1…
Sub Task 1.2…

Step 4: provide didactical details for the nZEB tasks and subtasks (the actual ULO content)
We assume that it is not needed to describe the Basic tasks, those are in most cases already covered in existing national qualifications for regular education.

Step 4		
Knowledge involved	Skills involved	Competence involved (responsibility and autonomy)
(items separated with ';')	(items separated with ';')	(items separated with ';')
Knowledge required to successfully carry out the sub-task.Please do not work them out as ULO's lists of keywords are enough!	Understanding and ability (skill) required to successfully carry out the sub-task Skills need to be described in active form using verbs from BLOOM's taxonomy	The ability of the learner to apply knowledge and skills autonomously and with responsibility Competences need to be described in active form using verbs from BLOOM's taxonomy

Step 5: Connect the tasks and subtasks to specific technical components

This link can be used later on to connect the ULO's to BIM-models. For example in BIMaxon.

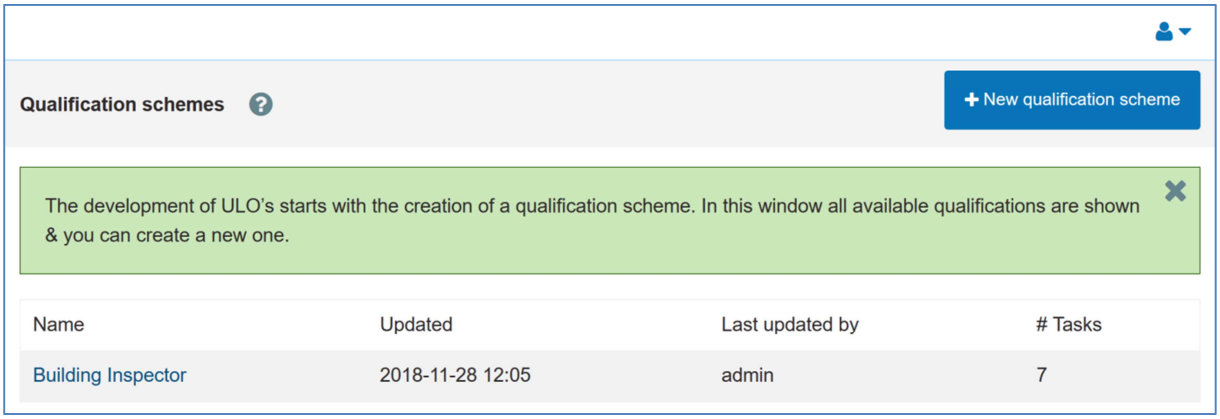
Step5	
An overview of task and subtasks	Links to functional elements in BIM Technical name /code of the element
Task 1…	Roof
Sub Task 1.1…	Roof
Sub Task 1.2…	Roof
Task 2…	Duct

Database funcationality for the BIM-enhanced Qualification Framework

The final version of the BIM-enhanced Qualification Framework is added to an easy to use normalized database and for Lithuania in a digital taxonomy tool BIMaxon. These databases are both accessible by API (application programming interface) to enable BIM-tools to make use of it. Testing and fine-tuning of these possibilities will take place in several pilot fieldlabs as described in D3.5 and D4.4. Development of this functionality was possible due to cooperation between BIMplement, BuildUpSkillsNL and H2020 NEWCOM. The database is added as an extension to the BUILD UP Skills advisor-app database.

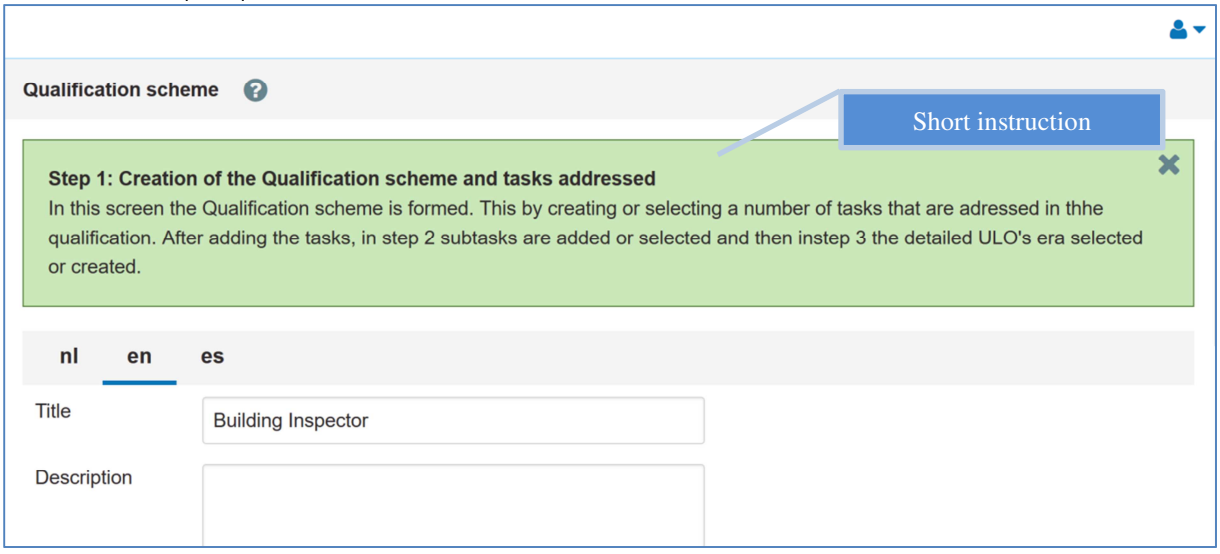
Accounts to the QF-database can be requested at ISSO by Jan Cromwijk (j.cromwijk@isso.nl)

Screen 1: Overview and creation of qualification schemes



Screen 1a – overview and creation of qualification schemes

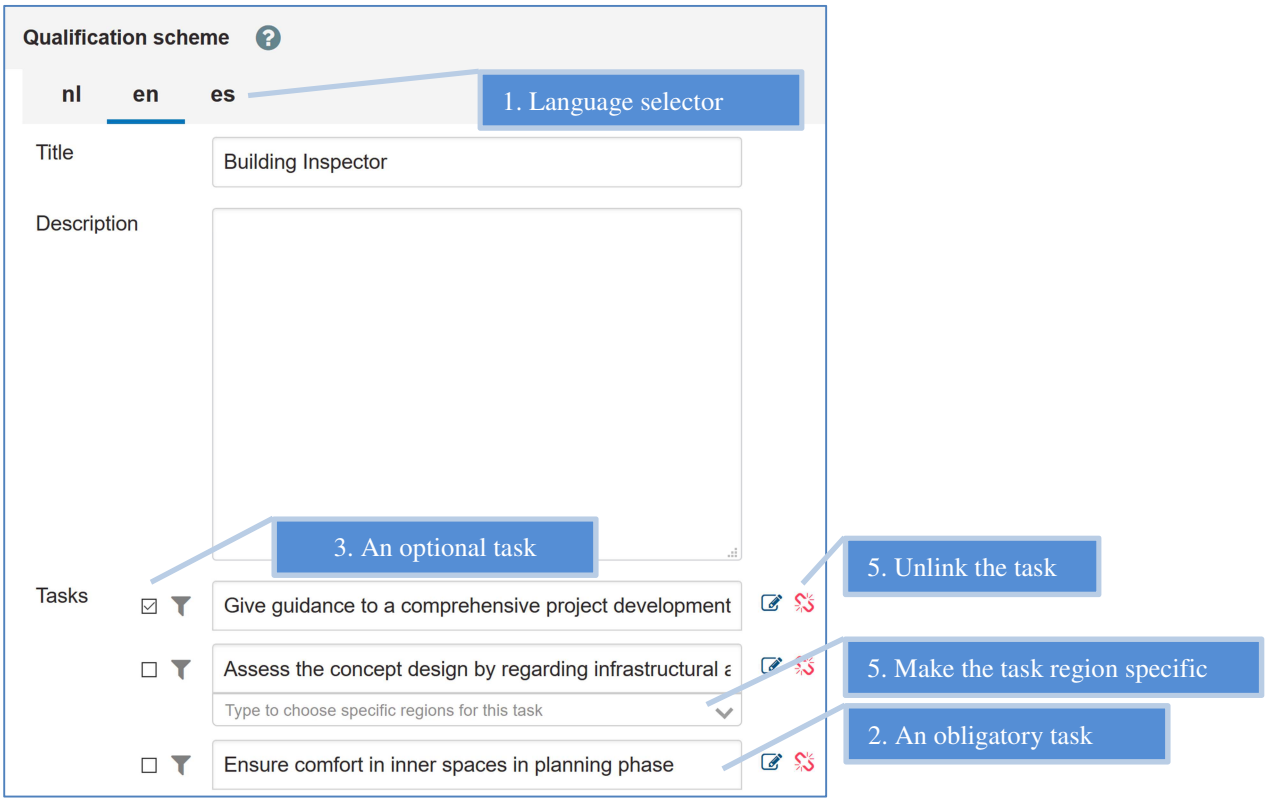
In this first step a qualification scheme can be selected of created



Screen 1b – Adding a new of qualification scheme

The qualification scheme is a collection of tasks that are worked out as Unit of Learning Outcomes (ULO's).

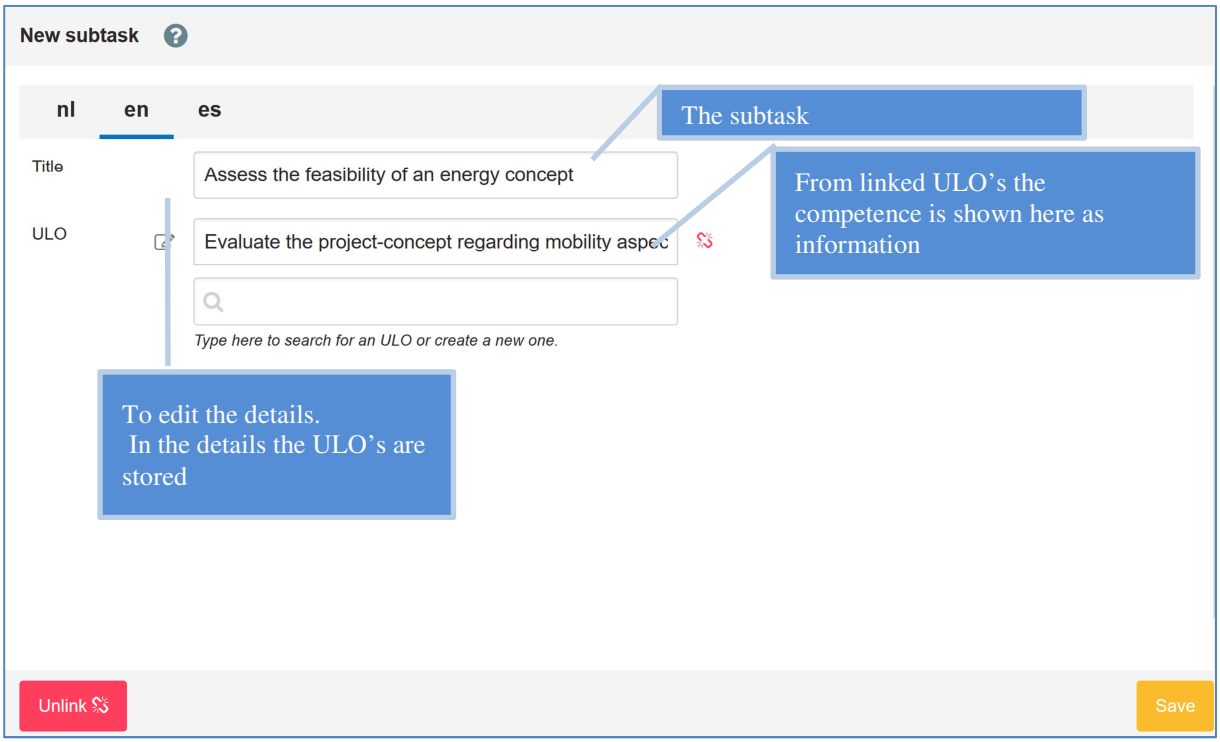
Screen 2: Creation of the Qualification scheme



Screen 2 – creation of the qualification scheme and involved tasks

1. A title for the Qualification scheme is given
2. Tasks addressed can be selected and/or created
    1. A task by default is defined in English, it can be translated to other languages
    2. A task is by default obligatory
    3. A task can be made optional
    4. A task can be optional for a specific region, for example for regional specific solutions
    5. Tasks are linked to the Qualification scheme, in this way they can be re-used in other schemes. Removing the link is possible

Screen 3: Overview and creation of qualification schemes



Screen3 - Selecting and creating subtasks

In this screen the subtasks are added to the tasks addressed within the qualification scheme.

Screen 4: Editing of an ULO

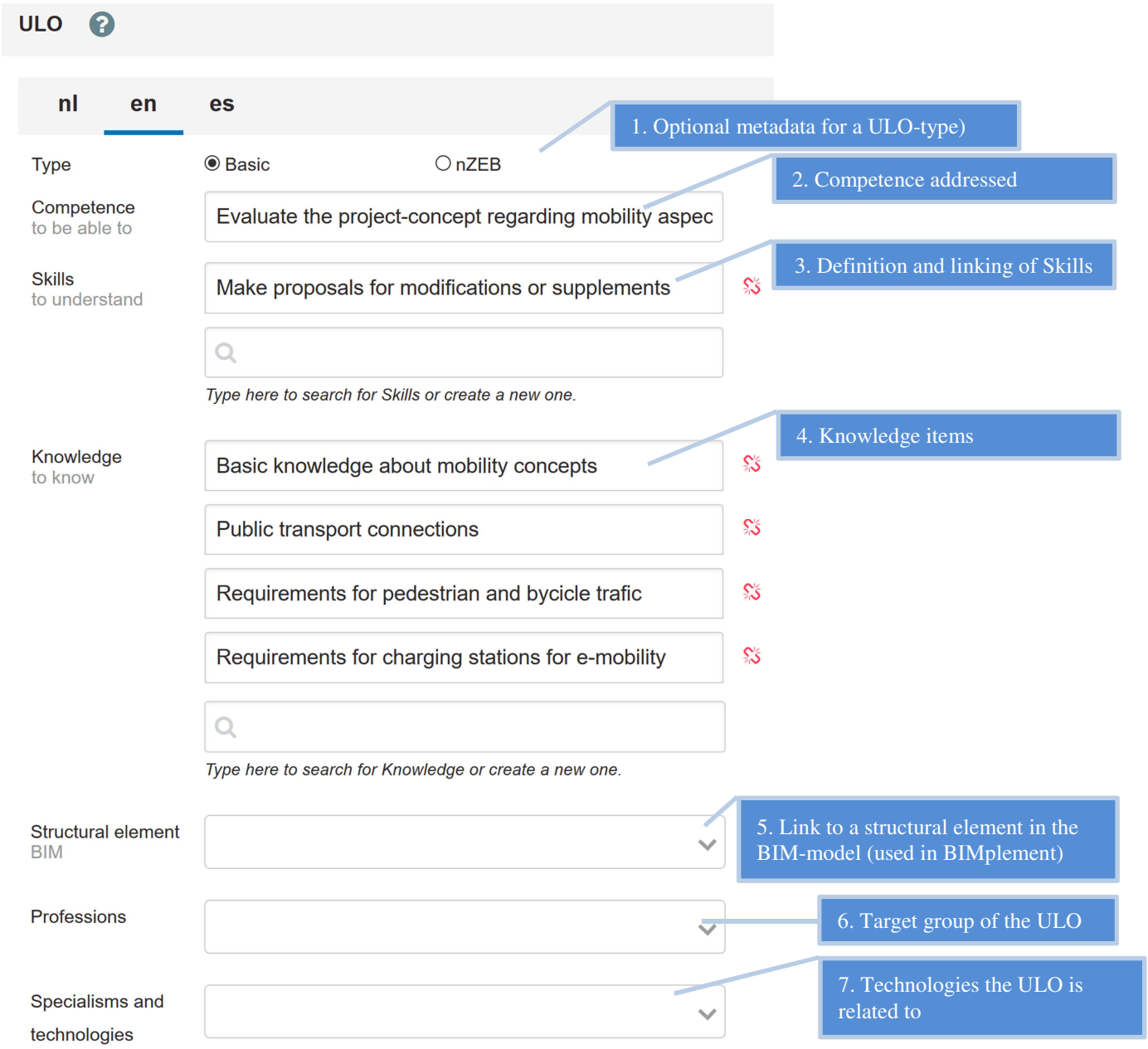
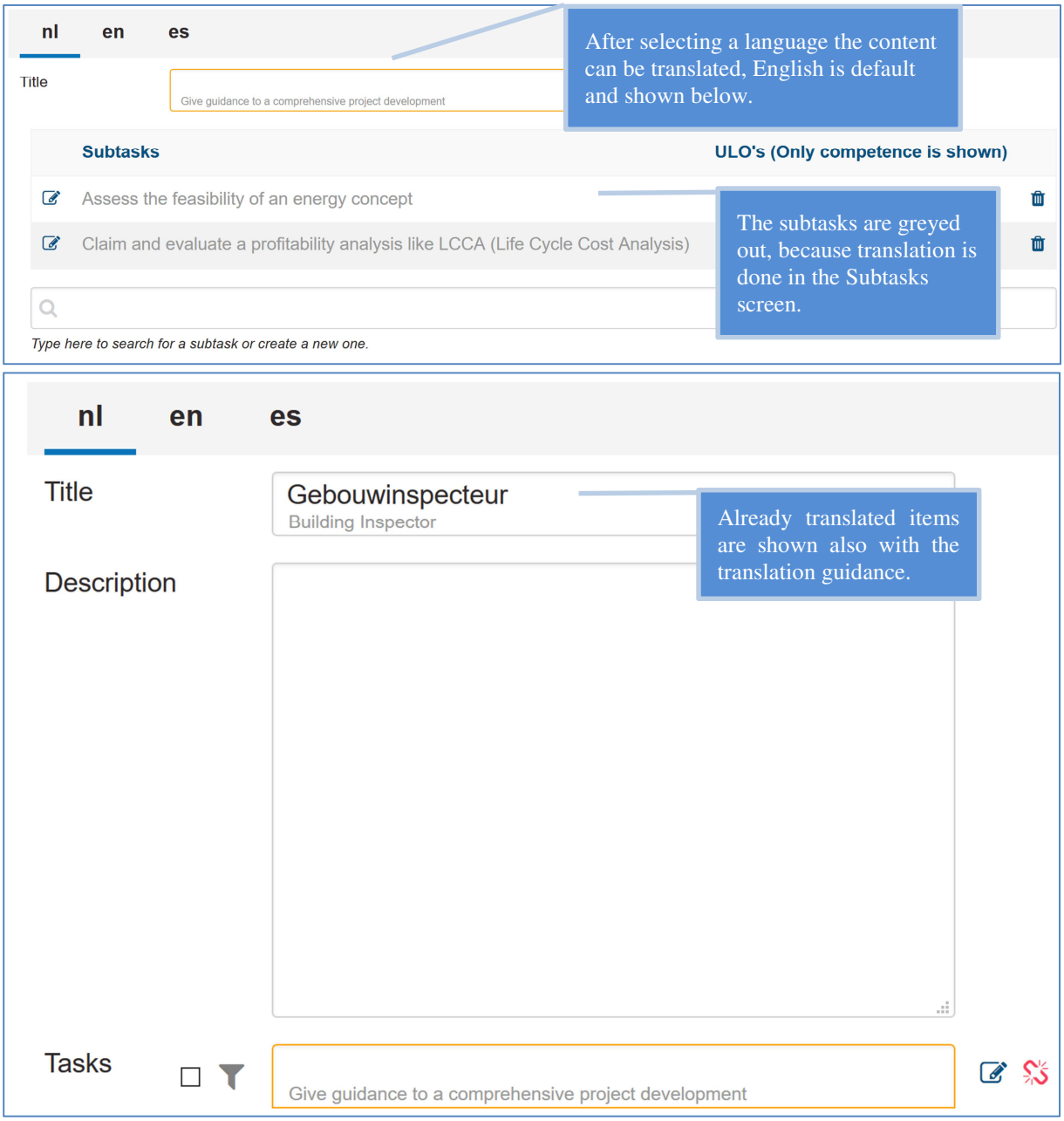


Image 1: Screen 4– the edit screen of a ULO

In this screen the ULO is edited

1. The type of ULO (optional)
2. The competence addressed
3. The skills that are part of the competence
4. The knowledge that are part of the competence
5. The building part (optional, for future linking to BIM-models)
6. The professions involved (optional, for future linking to BIM-models and the BUS-app)
7. The specialisms / technologies involved (optional, for future linking)

Screen 5a and 5b: Translation example



Screens 5a and 5b some Translation examples

Annex I Aggregated results from T2.1

In this annex, results from the performed iterations are integrated into a set of tasks that have to be performed when applying a ventilation system in an nZEB building (a domestic dwelling) while using BIM to deliver more quality in an efficient way.

BIMplement (Task classes) for subtasks

BAS	Basic task	(we do not detail these tasks, they are only mentioned)
BIT	BIM task	(all tasks to BIM empower the work to be done (more efficient))
nZT	nZEB Task	(all tasks concerning application of nZEB technologies)

Aspects of quality control are integrated into the task descriptions

S0 STAGE 0: Strategic Definition (BIMAXON-STAGE)

1. Perform site analysis
    a. site meteorological data
    b. local risks (air, soil)
        i. pollution (air, soil)
        ii. radon
2. Find out client's need and requests
    a. in terms of NZEB (Quality)
    b. in terms of BIM files
3. Determine if decentral balanced ventilation fits into the project definition
   Choice of the type of ventilation to be implemented in order to obtain nZEB building

S1 STAGE 1: Preparation and Brief (BIMAXON-STAGE)

1. Determine ventilation requirements
2. Determine noise requirements for the room in question
3. Determine possible combination with space heating
4. Determine list of stakeholders (clients, architect, design office, control office, constructors
5. Determine list of BIM stakeholders
6. Check available technical data and documentation
    a. technical data
    b. BIM data, ifc products & classifications

S2 STAGE 2: Concept Design (combined with stages 3 and 4 difficult to split tasks) (BIMAXON-STAGE)

1. Determine the needed airflow
2. Check if the airflow is higher than the legal requirements
3. Re-assure the type of ventilation to be implemented in order to obtain NZEB building
4. Determine location of the principal components in the building

S3 STAGE 3: Developed Design (selecting components & manufacturers)

1. Choose a ventilation device based on:
   - the type of heat exchanger (thermal or enthalpy exchanger)
   - wished combination with heating system or not
2. Determine the number of devices needed to provide the needed capacity

3. Determine the location(s) of the decentral balanced ventilation units based on:
   - the wall must be an outside wall
   - the wall must have enough strength for bearing the unit
   - the wall must be heavy enough (a least 200 kg/m2) of stiff enough to prevent vibrations
   a. interpretation of drawings, properties of the outer wall in terms of structure and composition
   b. check features and dimensions of decentralized ventilation units (clash detection)
4. Determine the type of outside grill(s) (round or brick form)
5. Determine the size (diameter) of the hole(s) to be drilled in the inner layor of the wall (part until the insulation)
6. Determine the size (diameter) of the hole in the outside wall if the outside grill is not brickform
7. Provide a connection to the net of electricity (power supply 230 V)
   Check information about power connection
8. If more decentral balanced ventilation units are necessary a multi-wired connection between the units is needed for control purposes.

S4 STAGE 4: Technical Design

1. Perform calculation of the air network
   a. minimize the loss of pressure
   b. Check the coherence with the thermal (nZEB) calculation
2. Check easy access to the ventilation system
3. Draw the air pipes network, and check there is no conflicts with the structure or other networks
4. Draft the technical implementation file (contains 3 chapters (in France))
5. Define a maintenance plan
   a. Define preventive, corrective and predictive maintenance actions
   b. Establish calendar for maintenance actions
   c. Determine actions that must be carried out by professionals or by users themselves
   d. Create the Building Log Book (Maintenance Instructions)

S5 STAGE 5: Construction

5. Field / manage tracking Check if this is the right moment in the planning
6. Safety planning Check if safety measures are in place
7. Create wall passages for supply and exhaust air
   i. Determine the location where the system must be mounted
      i. check how many connections have to made to the system (supplier documentation)
      ii. determine the needed space for the system (supplier documentation)
      iii. determine stiffness of the wall
      iv. check if there are cables or tubes in the wall
   j. Mount the drilling template
      i. Check with Augmented Reality measuring if the drilling template is place correct
   k. Drill needed holes :Ø 300 – 350 mm in the wall

8. Install ducts in the wall (air and water tight)
    l. Realize air- and water-tightness
        i. Make photo's between the steps that have to be performed to realize air- and water- tightness
        ii. Measure the airtightness with a Sound-brush
9. Mount external grills
10. Mount / install a decentral balanced ventilation unit
11. Document installed quality (following protocol)
12. Measure and adjust airflow(s) according to the design
13. Interconnect decentral balanced ventilation units
    (when there is more than one unit in the space)
    a. Measure and adjust airflows
    b. Document the settings made

S6 STAGE 6: Handover Construction and Close Out

1. Check overall Quality
    a. location of the elements
    b. pipes slope and diameter
    c. water and air tightness
    d. cleaning during the works
    e. acoustic insulation
2. Pilot testing
    a. Check necessary flow with the minimum engine speed
    b. Check noise production
        i. Of the ventilation unit
        ii. In the canal-system
        iii. At the ventilation grilles
3. Create As-built records
    a. Check if all to be documented actions are documented properly

S7 STAGE 7: In Use
Noting described yet

Example of a didactically detailed task

Realize air tightness around exterior ventilation devices
K1: what to know (that air and water tightness is needed)
K2: what to understand (why air and water tightness is needed)
K3: what activities to be able to

1. Realize a Mortar finishing for the pipe sheat
2. Protect the sheath with
    a. bituminous felt OR
    b. lightly expandable foam
3. Place expanded polythene around the vent (interior and exterior)
4. Outside : place a PU or silicone seal
5. Inside : place an acrylic seal

Annex II Extended and interpreted BIMplement ISCO-08

Classification system: ISCO-08 Code: ISCO on http://bp.ics.infinibim.com/classifiers/43/tables/214

ISCO-08	Name	Description
Construction		
2142	Civil Engineers	
2142	Structural Engineers	Deals with statics, mechanics, solid mechanics, and with the conception, analysis, design and construction of components or assemblies to resist loads arising from internal and external forces.
HVAC en Energysystems		
2144	Mechanical Engineers	Designer of materials and systems for HVAC and sanitary equipment, considering the limitations imposed by practicality, regulation, safety, and cost.
2142	Energy System Engineer	Designer of materials and systems for HVAC and sanitary equipment, considering the limitations imposed by practicality, regulation, safety, and cost. In charge of energy consumption optimization
1330	Building Automation Engineer ICT technology services managers	Designer of building automation systems, system engineer / system integrator, considering the limitations imposed by practicality, regulation, safety, and cost
2143	Environmental engineer	In charge of energy consumption optimization, as well as environmental impacts (water, air, comfort, health ...)
Electrical systems & domotics		
2151	Electrical Engineers	Designer of power, lighting, (data and or communication installations), considering the limitations imposed by practicality, regulation, safety, and cost.
1330	ICT Engineer	Designer of data and or communication installations, considering the limitations imposed by practicality, regulation, safety, and cost. + GTB Consulting with clients, management, technicians to assess the needs and system requirements Directing the selection and installation of ICT Overseeing security of ICT systems
Construction management		
1323	Construction manager/ Manager of Building Process	The person responsible for economy, health, delay, quality assurance during on-site construction works in the realization of nZEB buildings Interpreting architectural drawings and specifications Preparing tenders and contract bids Ensuring adherence to building legislation and standards of perofmance, quality, cost and safety
1323	Project Manager	The person responsible for the planning, execution and closing of any (nZEB) building project and contracts. Negotiating with building owners, property the construction process to ensure projects are completed on time and within budget Building under contract, or subcontracting Coordinating, operating and implementing the work programme for the site. - Also in charge of the realization of the as-built building files. Overseeing the selection, training and performance of staff and subcontractors. Arranging inspections by relevant authorities
3123	Building construction supervisor	Coordinate, supervise and schedule activities of workers engaged in the construction/renovation

1211	Cost Expert, Cost Engineer Finance manager	The person responsible for financial aspects during planning, execution and closing of any (nZEB) building project. (Not meant is financing of the project)…. Including the additional unexpected work
Facility management		
No code	Facility Manager	The person responsible to maintain the real estate as it was realized at the end of the nZEB building process (including facility management).
No code	Technical Energy Engineer	Person responsible for management, monitoring, energy optimisation and improvement of operation of facilities.
Financing and procurement		
1323	Procurer, Chief Procurement Officer 1323 Construction manager (also 1211 Finance manager)	The person responsible for facilitating the process of nZEB tenders and (sub)contracts c) negotiating with building owners, property the construction process to ensure projects are completed on time and within budget d) preparing tenders and contract bids h) building under contract, or subcontracting specialized building services
No code	Project Developer	The project developer takes responsibility for the associated risks involved in the building process for the customer and hands over the project to the tenant / buyer after completion and use of the building
Architects		
2161	Building Architects	Architects investigate, design, and oversee the construction and development of buildings, urban spaces, infrastructure projects, and social spaces. They design in accordance with the surroundings and regulations applicable in specific geographic areas, taking into account factors that include function, aesthetics, costs, and public health and safety. They are aware of social contexts and environmental factors, which include the relationships between people and buildings, and buildings and the environment. They engage in multidisciplinary projects aimed at developing the social fabric of a geographic area and advancing in social urbanism projects (definition ESCO).
BIM		
No code	BIM manager	Coordinate the BIM correspondants check the different trade BIM model verify the compatibility of the different trade BIM models assemble the as-built final model
	Company BIM correspondent	Realize, modify and adapt the company BIM model (companies that are requested to realize a BIM model by the client)
2161, 2142, 2144	BIM engineer	Realize, modify and adapt the technical design office BIM model
2161	BIM architects	Realize, modify and adapt the architect BIM model,
Technicians and Associate Professionals		
3112	Civil Engineering Technician	Inspecting buildings and structure during and after construction/renovation to ensure they comply with nZEB building laws and approved plans, specifications and standards as well with rules concerning quality and safety of buildings
3112	Building inspector	ensuring compliance inspecting buildings and structures during and after construction to ensure that they comply with building, grading, zoning and and standards, as well as with other rules concerning quality and safety.
3113	Electrical Engineering Technicians	Assist the electrical engineer
3114	E-installations service mechanicElectronics engineering technicians	Assisting in design, development, installation, operation and maintenance of electronic installations and systems. Supporting electronics engineers
3115	Mechanical	Designing and preparing layouts of machines

	Engineering Technicians	and mechanical installations, facilities and components, according to the specifications
No code	Engineering service mechanic	From BUS-NL
Craft and Related Trades Workers		
7111	House Builders	Decide to realize a building, or realize it for a client Pilote the constructions, draft the general specifications, hire the architects and the different contractors Is responsible, in front of the client, for the perfect realization of the building Contrarily to most owner/client, house builder is a full time occupation.
7112	Bricklayers and Related Workers	Implement different type of elements for wall building, such as burnt bricks, concrete blocks, stone, but also, earth blocks, straw, wattle and daub, adobe, ...
7114	Concrete Placers, Concrete Finishers and Related Workers	Realize reinforced concrete walls, panels, beams, slabs, posts, ….
7115	Carpenters	Realize wooden structures for walls, floor, partitions, roof structure, ...
7115	Joiners	Realize small elements such as doors, windows, furniture, ...
7121	Roofers	Realize the covering of roof, openings in roofs,
7123	Plasterers	Implement the finishing interior layer of walls and partitions, including the secondary necessary supporting structure
7124	Insulation Workers	Lays insulation inside wooden beam structures, roofs, slabs, including air-tightness films in relation with plasterers
7122	Tile layer	Lays tile on floors and walls
7125	Glaziers	Lays glass within windows is disappearing because windows are now , in general, manufactured in factories
7126	Plumbers and Pipe Fitters	Install water pipes for fresh and used water, sanitary devices, (often also heating engineer)
3115	Heating engineer	Install pipes for heating system, install heating devices (boiler, water heater, ...) (often also plumber)
7127	Air Conditioning and Refrigeration Mechanics	Install air-conditioning / refrigeration devices
No code	Cooling service mechanic	From BUS-NL
7131	Painter and related workers	Realize the finishing layers of wall, interior and exterior : paint, rendering, coating,
7411	Building and Related Electricians	Realize the building wiring, including the data collectors and electric devices (ex : ventilation)
7412	Electrical Mechanics and Fitters	??
No code	Ventilation fitter	New trade, arriving on the market : give advice on the type of ventilation to be chosen, on the installation plans (namely the position of ventilation and air duct …) lays the air ducts and the ventilator, fixes the air entry and extract, controls the installation quality
No code	General/works foreman	Responsible of a blue collar team (around 10 for "small buildings")
No code	ceiling installer	Install false ceilings
No code	Works planner building sector	In charge of the structural work planning/organization between the different stakeholders/companies
No code	Works planner installation sector	In charge of the finishing work planning/organization between the different stakeholders/companies
No code	maintenance	In charge of the maintenance of buildings - owner or inhabitant - electrical worker

		- plumber

ANNEX III Connect to BIM-models

BIM_model_of_NZEB related functional, technical systems and list of related general construction and engineering technologies Structure

Model tree structure coding	Level 1	Level 2	Level 3	All Countries Could fill there technologies EXAMPLE: Lithuanian ENERGOTRAIN Technologies list Technologies/Operations Zone
		BIM Model tree (Based on ISO81346) - Later USE BIMAXON for Mapping all Tree		
AA. Functional systems	A Ground system			
AB. Technical systems		**AB** Foundation construction		
AC. Element			? *Insulation element*	
BA. Technology				? *Insulation technology*
AB. Technical systems			BB Foundation structure	
AB. Technical systems		**AC** Slab construction		
AB. Technical systems			BC Slab structure	
AB. Technical systems			BG Ceiling structure	
AB. Technical systems			BF Floor structure	
AA. Functional systems	B Wall system			
AB. Technical systems		**AD** Wall construction		
AB. Technical systems			? Insulation and façade finishing	
BA. Technology				? Ventilated facades installation
BA. Technology				? ETIC fasades installation

....

AB. Technical Transporting systems		JG Heating distribution system		
				IG1 Low-temperature radiant heating systems
				JG2 Floor heating, radiator and convection heaters
				JG3 Renewable energy sources for heating
AB. Technical Transporting systems		JH Combined heating and cooling distribution system		
AB. Technical Transporting systems		HD Heating supply system		
AB. Technical Transporting systems		HC Cooling supply system		
AB. Technical Transporting systems		HE Combined heating and cooling supply system		
AA. Functional systems	J Ventilation system			
AB. Technical Transporting systems		JJ Air distribution system		
				JJ1 Mechanical ventilation systems

Structure elements coding descriptions:

AA. - Functional systems structure element (1 letter); AB. Technical systems structure element (2 letters); AC. Elements/Components mapping (3 letters) - USE ISO81346

BA. - Construction or engineering system technology structure element; BB. Operation (smallest work item (activity) in construction technology process)

C. Resources; CA. Work (Role) name (White or Blue collor worker competence); CB. Materials; CC. Mechanism;

ANNEX IV a step by step guideline for T3.1.1

Please provide your input in the attached Excel until 23 March – sent filled Excel to ISSO, HIA.

The step by step instructions for T3.1.1 are as follows:

1. **Choose two identified critical points that need careful detailing to ensure airtightness** for a specific building structure (Excel columns B-C).

2. **Cover all RIBA building stages** (different Excel sheets)

Each tab presents relevant building stage where it is user RIBA simplified stage definition. It is assumed:

- Preparation phase (Stage 0-2);
- Design phase (Stage 3-4);
- Construction/Installation phase (Stage 5)
- Handover phase (Stage 6)
- In use and maintainance (Stage 7)

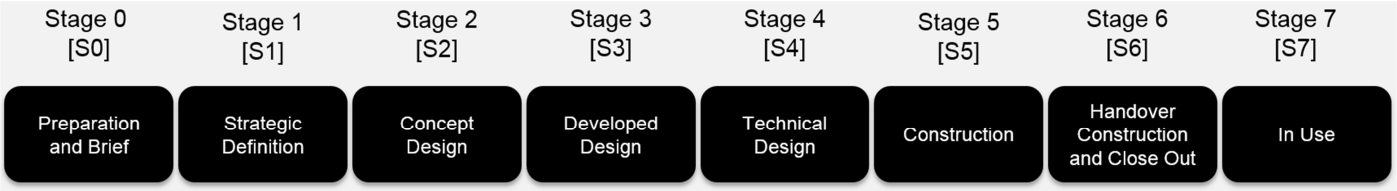


Figure 1: Project stages in the UK's RIBA Plan of Work 2013, picture by Donatas

3. **What are the activities/tasks to be performed** (columns D-G) **& who are the actors** (column H)

Create an overview of tasks through the whole building process (stage 0-7):

a) Enlist basic tasks
b) Enlist nZEB specific tasks
c) Enlist BIM specific tasks

4. **Detail nZEB and BIM specific tasks in didactical terms (knowledge, skills, competences,** columns I-K**):**

This is not needed for basic tasks. The focus is on nZEB tasks. Also relevant BIM tasks are to be defined that help reaching desired quality of nZEB task. It is assumed that basic construction tasks are known to the user of this qualification matrix. Commonly, the description of basic tasks can be found in national qualifications of each European member state.

5. **Discuss result with relevant stakeholders**

Please contact relevant national organizations, companies to realize the objectives of task T3.1 (starting with T3.1.1) and also to get first feedbacks on the usefulness of the QF.

Foreseen steps after to come from Implementation (WP3) to Demonstration phase (WP4) –.

a) Enter result in BIMaxon (HIA and ISSO will discuss this with Donatas)
b) Connect the identified activities and didactical tasks with relevant trainings, education material etc.
c) Link BIMaxon to instruction and/or inspection resources
d) Connect BIMaxon to selected BIMtools
e) Perform tasks with performance support from BIMplement
f) Evaluate performance (quality checkpoint).

ANNEX V Introduction to Units of Learning Outcomes

From the TWG2 report created after the 10th EU BUILD UP Skills exchange meeting and from H2020 project Train-to-nZEB the following formatting conventions and definitions are taken.

Formatting conventions: green text indicates knowledge to be gained, orange text highlights skills to be developed, red text summarises competencies.

Image 2: Formatting conventions for ULO's as used in Train-to-nZEB

The TWG2 group used the following definitions bearing in mind the European Qualifications Framework:

1. **'knowledge'** is the body of facts, principles, theories and practices that is related to a field of work or study
2. **'skills'** means the ability to use know-how to complete tasks and solve problems, and they can be cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments)
3. **'competence'** is the capacity to apply, in daily work, the knowledge and skill, i.e. someone knows how to do a task besides knowing the theory.

A unit of learning outcomes (also called "unit" or "module") is a component of a qualification consisting of a coherent set of knowledge, skills and competence that can be assessed and validated.

Table 5: Example: Documentation of a mobility phase in the training course "Biological Laboratory Assistant" at the vocational college in Hilden (Mettmann)

Unit	Separation of biomolecules (e.g. gel electrophoresis, chromatography)		
Duration of the Unit : 4-6 weeks Learning outcomes correspond to EQF level 5	**Knowledge**	**Skills**	**Competence**
	The learner knows the molecular characteristics of a bio molecule (e.g. protein, sugar, nucleic acid)	The learner understands the functionality of a specific seperation technique (e.g. SDS-PAGE, agarose gel electrophoresis, chromatographic techniques)	The learner is able to apply a specific separation technique autonomously (e.g. SDS-PAGE, agarose gel electrophoresis, chromatographic techniques)

Image 3: Example of a ULO, distinguishing 'To know', 'To understand' and 'To be able to'

7. COLOFON

BIMplement

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The information in this publication does not necessarily represent the view of the European Commission.