BIMplement

Towards creating a learning environment in the building sector through the development of a large-scale, flexible qualification methodology that integrates technical, cross-craft and BIM-related skills and competences

www.bimplement-project.eu

Report:	**D5.1 Replication and exploitation plan**
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Date:	29-01-20
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HISTORY OF CHANGES		
VERSION	PUBLICATION DATE	CHANGE
1.0	10-12-2018	Initial version (structure)
1.1	02-11-2020	Updated final version
1.2	29-01-2021	Revision due to the review meeting, more details on future actions, indication of the needs of Blue-Collar and White-Collar workers

1 Introduction

1.1 The Replication and Exploitation Plan – REP

Under Horizon 2020 and the BIMplement project contract, a replication and exploitation plan needs to incorporate detailed replication and exploitation strategies that clearly define how the project results will be implemented and how they will impact on the market, future developments and policymaking. The BIMplement replication and exploitation strategy aims at deliberate efforts to increase the impact of successfully tested and innovative qualification and training schemes.

What is a REP and what is its scope?
In terms of protection of results, the REP is not limited to industrial and intellectual property rights (e.g. patents, trademarks, design rights and copyright). The results generated under the project could be any tangible or intangible output, more particularly data, knowledge, or information, whatever its form or nature, whether it can be protected or not. Business information or valuable know-how can be protected via contractual mechanisms such as via non-disclosure agreements or trade secrets.

The structure of the REP draws on the template provided through H2020 “Support Service for the Exploitation of Research Results (SSERR) service prepared by the META Group (October 2018). The development of the plan was also improved because of the Exploitation Strategy Seminar (ESS), which is a key service that allows partners of an energy research project to consider the potential of project results and their exploitation routes. It aimed to provide the most appropriate environment to facilitate an open discussion, including:

- The identification/grouping of key exploitable results and definition of the related replication and exploitation strategy.
- The road-mapping of follow-up actions.
- The identification and mapping of risks related to the exploitation.
- The development of a draft plan for the replication and exploitation of project results and linkages with relevant stakeholders.

The terms replication and exploitation referred to in this document are defined as follows:

- ‘Replication’ means the process of repetitive use of the project results and created capabilities in other territories and/or areas to realise economic and environmental benefits without substantially changing the initial form and/or content of the results.[1]

- 'Exploitation' means the use of results in further research activities other than those covered by the action concerned, or in developing, creating, and marketing a product or process, or in creating and providing a service or in standardisation activities.[2]

1 Winter, Sidney. (2010). The Replication Perspective on Productive Knowledge. 95–121. 10.1007/978-3-642-04480-9_5. Sidney G. Winter and Gabriel Szulanski *Organization Science* Vol. 12, No. 6 (Nov–Dec, 2001), pp. 730–743.

2 Regulation of the European Parliament and of the Council laying down the rules for participation and dissemination in "Horizon 2020 – the Framework Programme for Research and Innovation” (2014–2020) and repealing Regulation (EC) No 1906/2006 – Draft.

Terms used:

'Use' is usually defined as the direct or indirect utilisation of the results in further research activities other than those covered by the project, or for developing, creating and marketing a product or process or for creating and providing a service.

'Direct use' implies that partners utilise the results themselves for commercial applications (e.g. by producing and/or commercialising a new product or service) and/or for further research ('further' with respect to the scope of the project in which the foreground is generated).

'Indirect use' implies that partners may allow third parties to exploit the results through a specific agreement.

The replication and exploitation concept statement is a clear, brief description of a key exploitable result (KER). Writing an exploitation concept statement is a critical task, whether starting a company to pursue the new opportunity or seeking to continue with research activities. Project partners should be able to describe the nature of the exploitation action clearly and briefly in a short document of one to two pages. It is common for the initial concept statement to change during the lifecycle of the project with feasibility testing and the writing of the REP.

1.2 Project Introduction

BIM for a nearly zero-energy building (nZEB) construction needs an enhanced systematic approach for the quality control of the entire process to reduce the gap between the design and actual performance of buildings. This requires a fully qualified and equipped workforce, capable of implementing, executing, and performing all the necessary labour actions with understanding of the responsibility of their own profession and actions, as well as the relation with the other involved professions and actions. BIMplement offers trainers and learners a range of tools that fit the objective of developing a fully qualified and equipped workforce, capable of implementing, executing, and performing all the necessary labour actions. The main aim is to achieve an improvement in quality for nZEB construction and renovation by setting up a large-scale training, Continuous professional development and qualification scheme that addresses entire process phases using a cross-craft and cross-level multidisciplinary approach, strengthened with hands-on and BIM-enhanced workplace learning tools according to following objectives:

1. To improve the overall quality of renovations and new constructions, based on a BIM-enabled workplace learning that addresses all process phases using a cross-craft, multidisciplinary approach.
2. To create a new generation of professionals and craftsmen, equipped and enabled by BIM skills to enhance the overall quality of construction and renovation across the entire process.
3. To foster interactions between different trades and professions enabled by a flexible qualification, certification, and accreditation methodology for implementing BIM as a workplace learning environment.

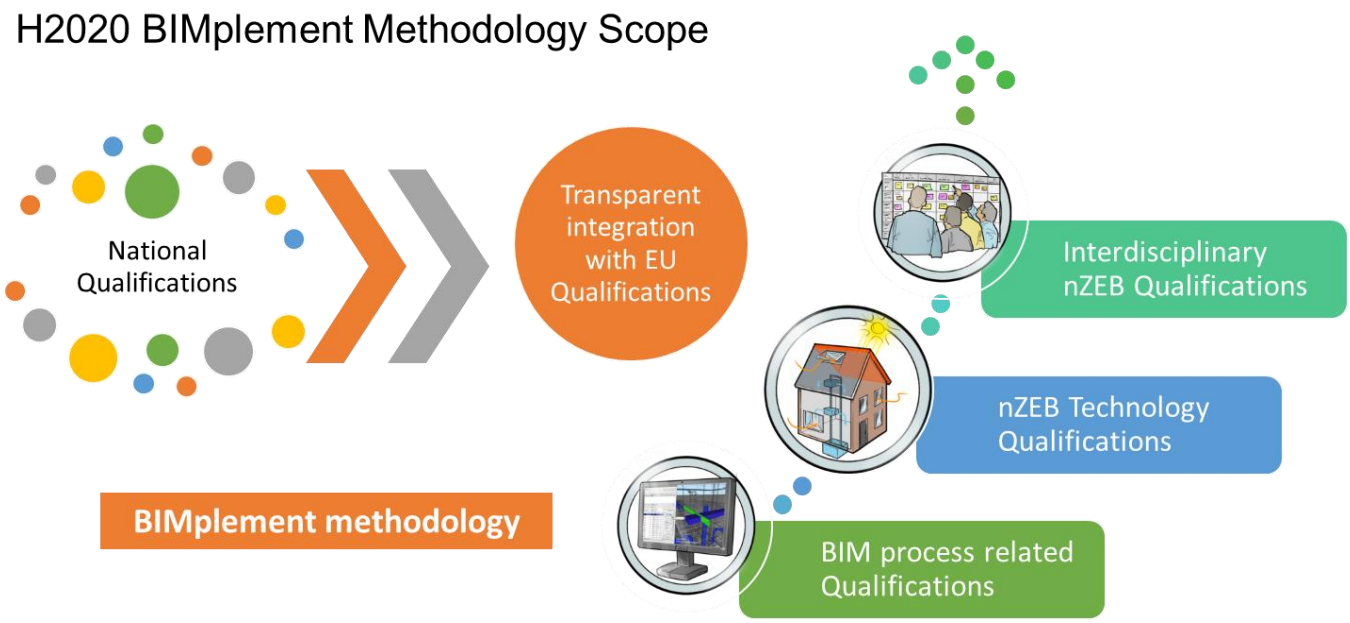


Figure 1: The project log frame

Replication and exploitation strategy

The replication and exploitation strategy aims to increase the impact of successfully tested, innovative qualification and training schemes. The objective of the plan is to ensure that the results of the project will benefit more member states and areas, while fostering further cross-border, cross-sector developments on a lasting basis. An upscaling of the methodology requires making strategic choices as to how it will be replicated in new areas or new countries, how it is to be organised, how resources will be used and how it will be monitored and evaluated. To this effect, the overall objective is to initiate and organise further exploitation and replication of the project results, to increase the number of skilled building professionals and craftsmen across the building value chain through a spill-over effect.

Implementation of the replication and exploitation strategy facilitates:

- Horizontal upscaling of the methodology to other/new topics (currently limited to ventilation and air tightness as an example).
- Sustaining the used content within existing tools.
- Cross-country upscaling of the methodology to other identified member states through a free and open methodology, implementation services and a shared and open development platform.

BIMplement addresses these aims by:

- Provision of a self-instruction guide for implementing new technical or conceptual topics and for implementation in other member states that can be further exploited and promoted by using the PROF/TRAC open training platform (D5.7) and https://www.bimplement-project.eu/ (BIMplement guides, D4.1, D4.2. D4.3., D4.5, D5.2, D5.5, D5.6).

- Making use of the BIM learning centres in which SME's and enterprises can learn with as little as possible financial barriers (D5.3. 5 agreements had been signed).
- Collaboration and connection with European umbrella associations (D5.4. Stakeholders' map).

The replication and exploitation plan (REP) summarises the strategy and concrete actions related to the replication and exploitation of the project results. It includes:

- Analysis and identification of possible upscale target areas and countries (making strategic choices regarding horizontal upscaling).
- Strategy and action plans to increase the scalability.
- Special indicators to assess the process, outcome, and impact of scaling up (determinants of success).
- A business plan (business model) to continue BIMplement activities after completion of the project.

2 Executive Summary

This replication and exploitation plan summarises the strategy and concrete actions for the protection, replication and exploitation of the results generated by the BIMplement project.

The current release was updated and completed by consortium partners during the project life in order to be delivered in its final official form at the end of the project (when partners are expected to report on the actual and projected applications for the results, i.e. on their strategy and concrete activities to replicate and exploit the project results).

This document is organised in terms of key exploitable results (KERs), which describe the strategy and concrete actions for replication and exploitation of the project's results. KER1 is referred to as a Methodology for a BIM-enhanced Qualification Framework, and KER2 as a BIMplement Kit: Training programme. Both KERs are subject to open use and exploitation by interested stakeholders:

1. OPEN: Multi-layered qualification matrix incl. self-service guide (consultancy = possible).
2. EXPLOITABLE: BIM-maturity-scan for composition of custom BIM trainings to level up skills (and to create equal-skill-level-playing fields).
   BIM-maturity-layers for BIM and Quality Assurance.
3. EXPLOITABLE: Training materials for the training of BIM coaches and BIM workplace coaches (EXPLOITABLE: can be upgraded to personal recognition) (separate KER).
4. OPEN: BIMplement guide for application of BIM to ensure quality on airtightness and ventilation systems (consultancy is possible).
5. EXPLOITABLE: The FIT2.0 mobile training container incl. BIM.

Open = freely available.
Exploitable = with a business model OR as an ingredient for a new project.

KER exploitation route (how the KERs will be further exploited in general)		
Selected route		**Implementing actor**
DIRECT USE	Commercialisation: *deployment of a novel product/service (offered to target markets)*	ISSO, ASTUS, IVE, LBA, HIA, LSA, MOW
	Implementation of a new university course (*Note that a training course is a service*)	IVE
	Recommendation of a new legislation/standard	AVE (in France), LSA (in Lithuania)
INDIRECT USE	Commercialisation: *deployment of a novel product/service (offered to target markets)*	Third parties (training organisations, construction companies, associations)

3 Key Exploitable Result 1 – Methodology for a BIM-enhanced Qualification Framework

3.1 Brief Description

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

The BIMplement qualification framework is setup as a multi-layered qualification matrix. It is composed of tasks that need 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 and BIM-related tasks. If needed, more layers can be added, for example, for indoor air quality (IAQ) tasks or circular building tasks.

3.2 Innovativeness Compared to Existing Products/Services

BIMplement offers trainers and learners a range of tools that fit the objective of developing a fully qualified and equipped workforce, capable of implementing, executing, and performing all the necessary labour actions in relation to nZEB. This is achieved through integration with the BIM environment.

3.3 Unique Selling Point (Competitive Advantage)

The result introduces a more narrowly defined qualification framework that enables the achievement of increased building quality with the help of better-defined task-based qualifications and BIM for nZEB.

3.4 Product/Service Market Size

The market gap opportunity is further explored by each country (Annex 2).

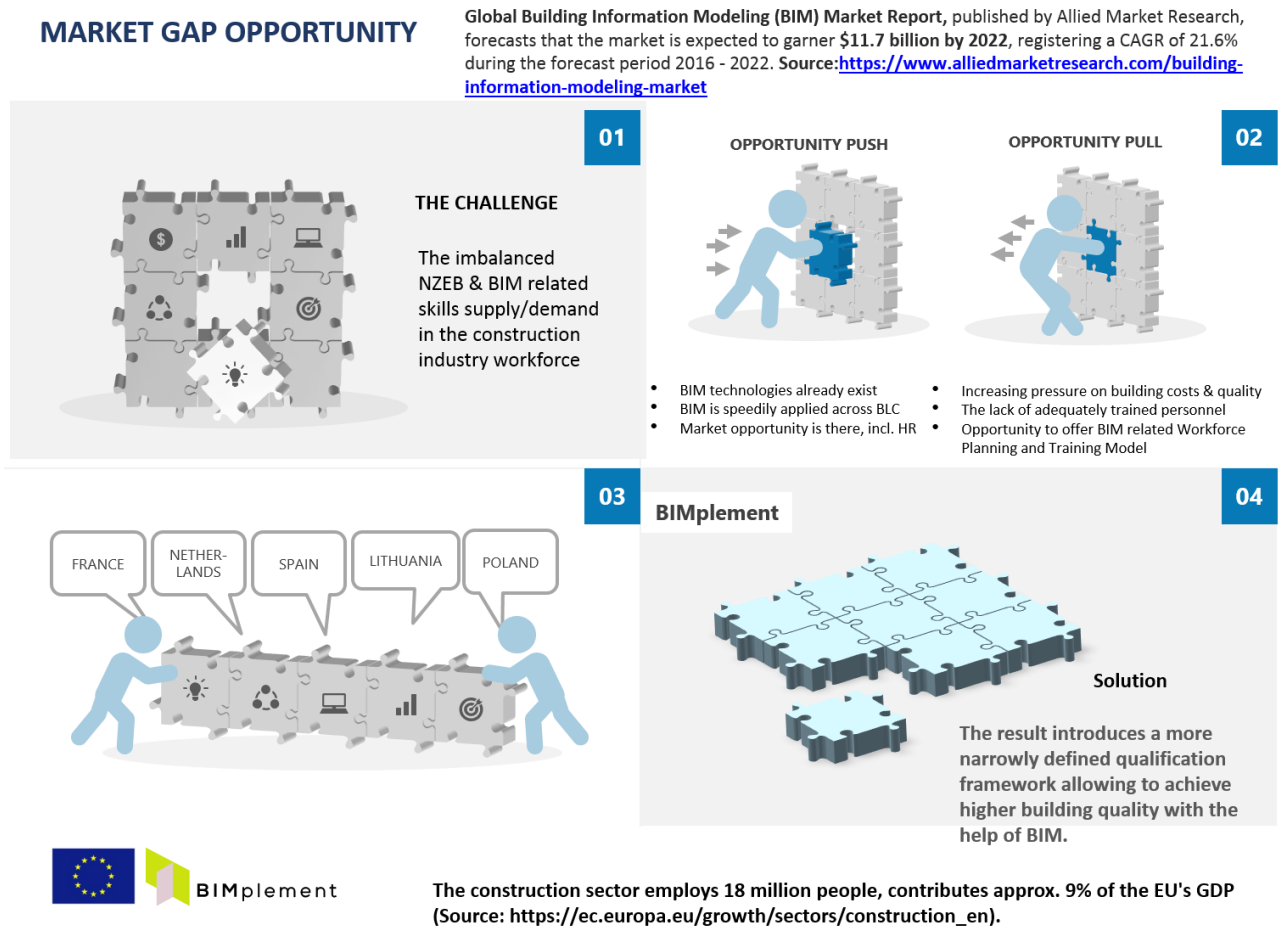


Figure 2: Market gap opportunity

3.5 Market Trends/Public Acceptance

The potential social impact is high as the aim is to improve the quality of nZEBs through skills development, thereby also contributing to the achievement of the EU 'Green Deal' goals.

3.6 Product/Service Positioning

BIMplement positions itself as a value-driven (high-level) solution. BIMplement methodology is defined as a method of applying BIM for qualification development and training towards the achievement of targets for energy efficiency in buildings. Consortium partners are uniquely positioned to make nZEB and BIM qualifications more closely aligned with the construction process. KER1 can also be exploited independently by companies involved in building nZEBs using BIM, as well as human resource consulting companies and/or training providers seeking a more qualified approach towards the development of qualifications, and therefore, better efficiency in the nZEB building process by using the BIMplement guide and instructors.

3.7 Legal or Normative or Ethical Requirements

Implementation of the solutions will depend on the application of national and international standards in the construction sector, especially in terms of energy efficiency, and the application of different qualification and classification systems. The challenge is in the various requirements for different EU markets.

3.8 Competitors

- Training providers that have proprietary methodologies that address qualifications and work skills in construction, while using BIM.
- Consultancy companies that have their own methodologies.

3.9 Prospects/Customers

KER1 potentially addresses the needs of multiple players in construction and related sectors (Figure 3).

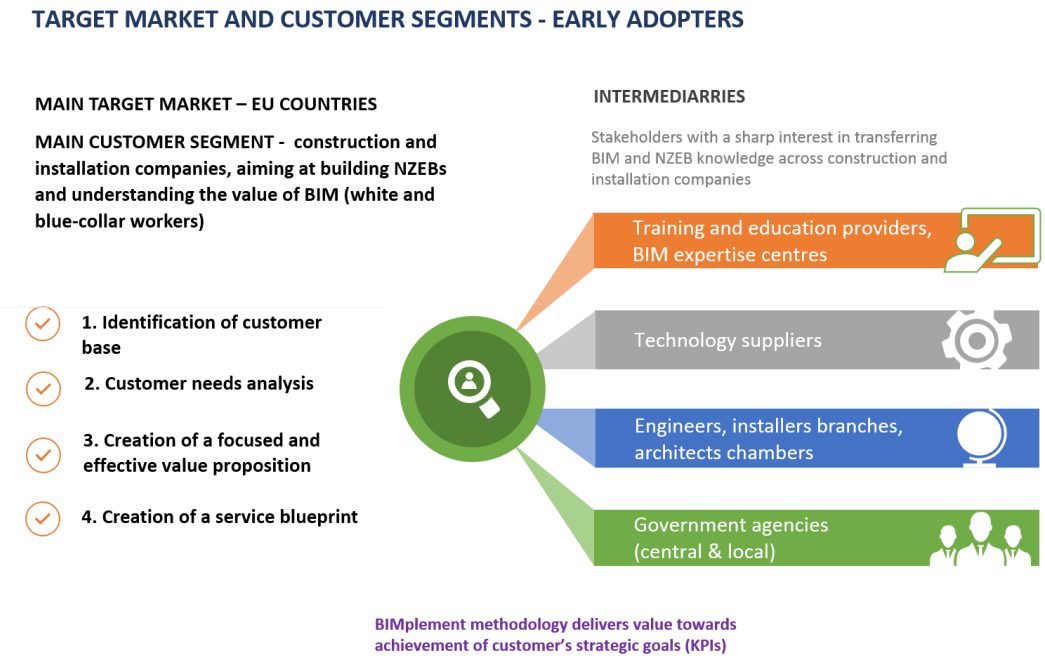


Figure 3: Customer segments

KER1 (methodology for a BIM-enhanced qualification framework) is not exploited directly but rather acts a common methodological framework that is used in different countries. While using KER1, the partners will offer different types of nZEB-related training services (as described in KER2) both nationally and at a European level.

In general, BIMplement offers trainers and learners a range of qualifications and BIM-related tools that fit the objective of developing a fully qualified and equipped construction workforce, capable of implementing, executing and performing all the necessary nZEB-related labour actions (Figure 4).

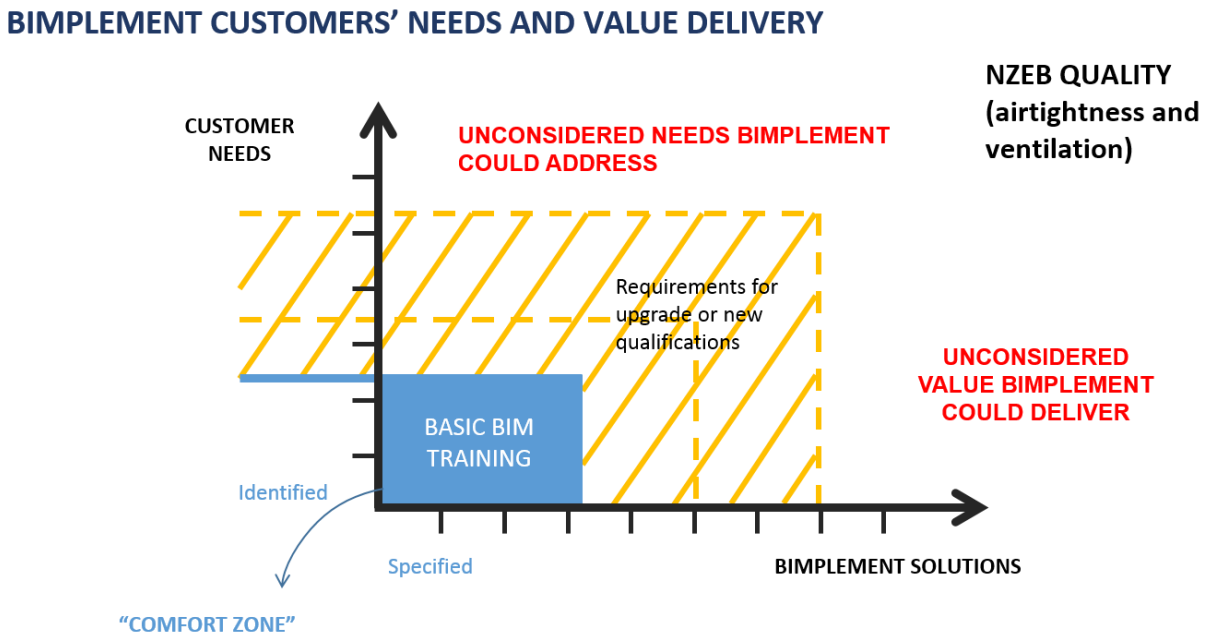


Figure 4: BIMplement customer needs and value delivery

There are variety of needs KER1 can address (Table 1).

Table 1: BIMplement customer needs

Customer	Needs
Building and installation companies	• to design, develop, and build nZEB, while using BIM • to improve process implementations • to enhance the construction quality control process with the use of BIM • to assess its BIM maturity level and training needs • to newly introduce BIM to the company • to train its staff (white- and blue-collar workers) on BIM and NZEB
Training providers, learning and (BIM) expertise centres	• to design a qualification and/or training programme for white- or blue-collar workers in the construction sector for upskilling BIM and nZEB skills • to provide training for white- or blue-collar workers in the construction sector for upskilling BIM and nZEB skills • to check the BIM maturity level of the company, BIM project or BIM project team • to market BIM and nZEB skills training programmes
Architect chambers	• to raise awareness among architects of quality control aspects in the design process • to increase architects' understanding of the role of other trades in realising quality in relation to architectural design • to promote the use of BIM towards the achievement of nZEB quality requirements
Engineers, installers, branches, and associations	• to raise awareness of quality control aspects in engineering, design, and the realisation process

(HVAC and building services)	• to raise understanding of the role of other trades in realising quality for building services • to scale up upskilling (BIM, nZEB quality requirements) • to create and publish task-based qualifications for upskilling • to standardise work processes for delivering quality
Technology & material suppliers	• to mainstream application of their product-related knowledge across construction and installer companies • to supply materials and technologies for the building education and training sector
Government agencies	• to promote and/or enforce the use of BIM towards achievement of nZEB quality requirements in specific territories • to scale up upskilling (BIM, nZEB quality requirements) • to make the playing field more transparent

3.10 Cost of Implementation (Before Replication and Exploitation)

BIMplement was funded under H2020-EU.3.3.7 and H2020-EU.3.3.1 with an overall budget of €999,620.

3.11 Time to Market

The methodology has been applied at the end of the project at selected construction sites and further replicated and exploited after project completion.

3.12 Foreseen Product/Service Price

At this stage it is difficult to calculate the potential costs of the service while using the developed methodology. This should become clearer during the actual deployment of the BIMplement method in the market. The price will depend on the service type.

3.13 Adequateness of Internal Staff

Project staff must adhere to the requirements to implement similar initiatives at a national level. Additional staff may be required to facilitate the application of the developed methodologies in other EU countries, if necessary.

3.14 Involving External Partners

The BIMplement method requires the involvement of multiple stakeholders both at a national and an EU level, which will serve as leverage towards the wider application of the methodology. At the current stage, the stakeholders are identified in the BIMplement Stakeholders map (D5.4). At least one agreement with a BIM expertise or training centre for each BIMplement consortium country has been made to further replicate and exploit KER1. The list of agreements is provided in Table 4.

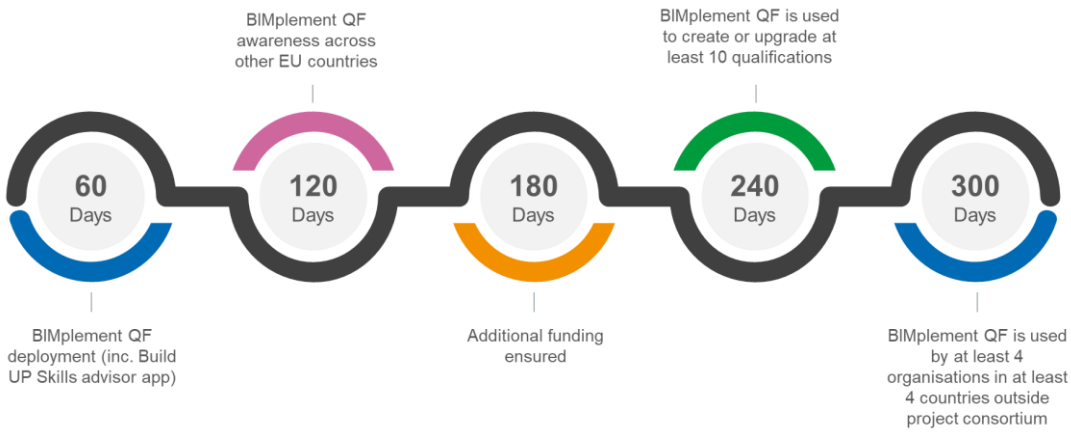
3.15 Status of IPR: Exploitation Forms

The products based on this KER come in the form of various types of trainings, certification (competences and process – quality assurance) and consultancy.

3.16 Replication and Exploitation Roadmap

The plan foresees the following KER1 European and national replication and exploitation actions:

Replication and Exploitation Roadmap	
Actions	*The actions required during the 12-month period after project completion:* • the tested self-instruction guide for the BIMplement qualification framework is published on the PROF/TRAC platform • to further prove the use of the BIMplement QF in combination with the process matrix for quality assurance • apply for additional funding (H2020, national governments) to further explore the application of QF in other areas and countries (e.g., Horizon 2020 project BUSLEAGUE, https://busleague.eu/) • apply the BIMplement qualification framework to other EU and national projects, as well as topics to further prove its applicability • optimise coaching for the training of new users of the BIMplement qualification framework • if needed, extend the BIMplement qualification framework • further experiment with connecting BIM-models/details with unit of learning outcomes and related upskilling sources • communicate the finalised result to member organisations in participating countries (NL, FR, ES, LT, PL) • communicate and disseminate applications and lessons learned • address the EU-wide market, with at least applications in Austria, France, Ireland, Spain, and Bulgaria • at later phases, extend the number of EU countries where the method is applied to >10 countries • continuous exploitation of the proftrac.eu • As a follow up to BIMplement a few partners participate newly established buildingSMART working group 'BIM & Building performance competences: PCERT-EP" that tackles task-based learning outcomes in an area of energy efficiency of buildings.
Roles	Most of the additional BIMplement method development and implementation activities will be carried out by ISSO, ASTUS, IVE, RIMC, LBA, HIA, LSA, whereas AVE and ACE will play a leading role in dissemination activities to spread the message about BIMplement methods to more countries.

Milestones	
Revenues	Some of the partners could potentially generate revenue by collecting service fees for the development of the qualifications and related consultancy. E.g. The Build UP Skills advisor app (NL) or statreg.lt (LT) could generate the fees for using the platform for the placement of new qualifications and attributed trainings. Otherwise, the background information for potential users will be free of charge, therefore, the user could potentially generate some revenue by using the BIMplement QF. The business models for each country are presented in Annex 2.
Other sources of coverage	To maintain the BIMplement QF some additional sources of funding will be necessary, e.g., partners' own budget, other project grants, national/regional incentives, and commercial revenues.
Impact in 3-year time	It is expected the results of the project will contribute to the Green Deal goals by reducing CO_2 emissions stemming from the construction and exploitation of buildings. It is assumed that triggering BIMplement primary energy savings will constitute ~9735 MWh in three-years' time (based on assumptions described in Section 5).

3.17 Replicable and Exploitable Results Priority Map

The priority map provides a snapshot of the most common risks faced by the project, which are previously identified through the risk matrix assessment tool (risk matrix). The risk matrix aims to identify the level of importance of the different risks factors in terms of achievement of each of the key exploitable results and the probability of such a risk occurring. The risk matrix analyses the following six different categories of risks:

- **Partnership risks:** internal risk factors related to the composition of the partnership or the specific behaviours of the partners, conflict of interests, etc.
- **Technological risks**: external factors related to the feasibility of the technology, its level of development, presence of other emerging technologies, etc.
- **Market risks**: external risk factors related to the fulfilment of marked needs, presence of competitors or alternative products, etc.
- **IPR risks**: factors related to the presence of similar previous patents, the possibility of protecting the developed technology/product, patent counterfeit, etc.
- **Environmental risk factors**: external factors related to the presence of or changes in legislation, standards, etc. Special attention will be given to the regulatory environment and standardisation issues.

- **Financial risk factors**: factors related to the availability of funds for progressing from the research stage to the prototyping industrialisation/commercialisation phase.

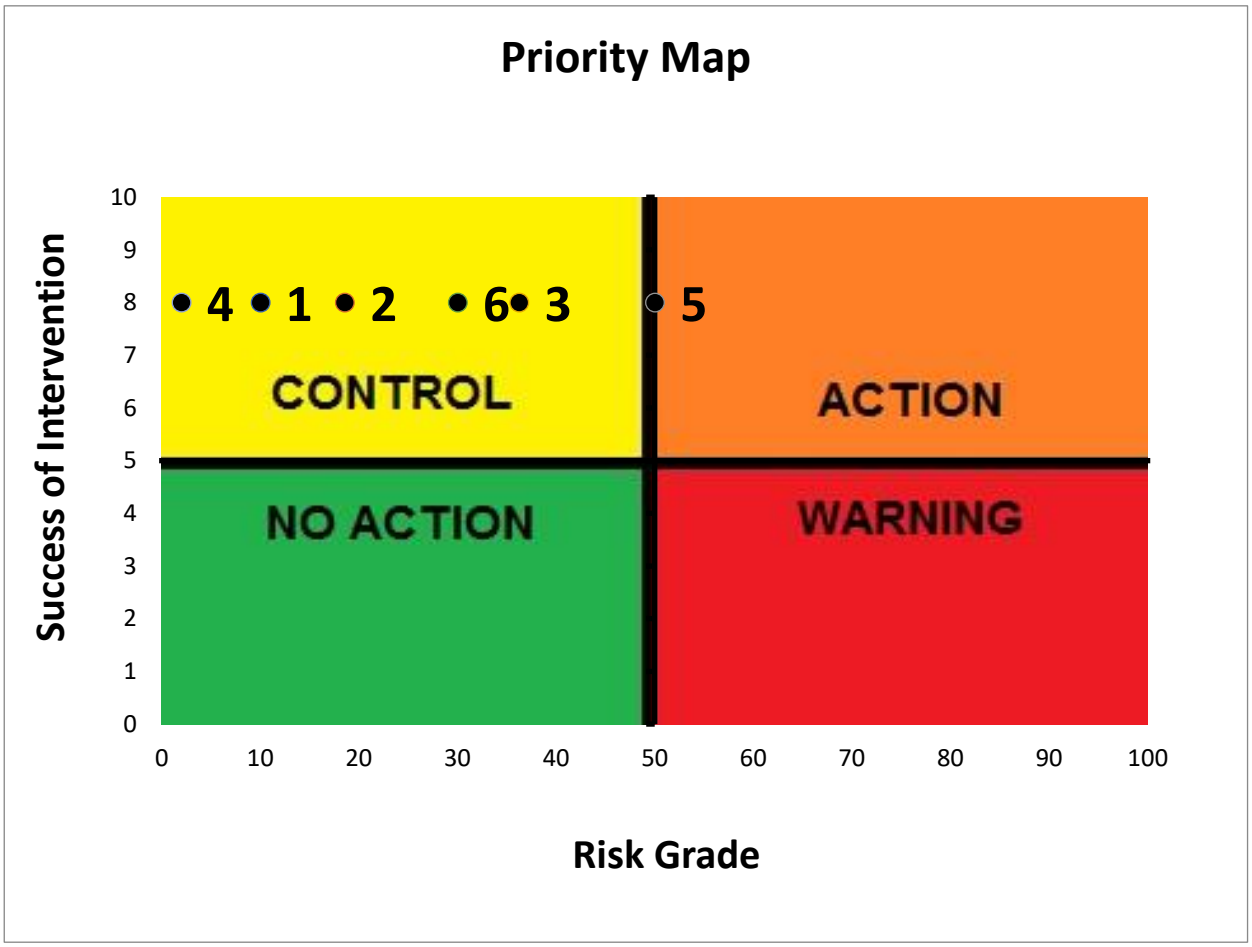


Figure 5: Priority map for KER 1

3.18 Risk Matrix for Replication and Exploitation

	Key Exploitable Results	Degree of Importance of the Risk Related to the Exploitation of This Key Exploitable Result. Please Rate from 1 to 10 (1=low, 10=high)	Probability of Risk Occurring. Please Rate from 1 to 10 (1=low, 10=high)	Risk Grade	Scope and Type of Potential Intervention	Feasibility/Success of Intervention. Please rate from 1 to 10 (1=low, 10=high)	Priority Level
1	**Partnership Risk Factors**	*5*	*2*	**10**		*8*	**80**
	Insufficient contribution from partners	*5*	*2*		Coordination and regular contacts	*8*	
	Disagreement on IPR	*5*	*2*		Identification of actual background and results, discussions on joint ownership implications	*8*	
	Different expectations/goals	*5*	*2*		Focus on the core, common content delivered by the project	*8*	
2	**Technological Risk Factors**	*7*	*3*	**19**		*8*	**149**
	No clear definition of end product	*6*	*2*		Testing of the product with potential users	*8*	
	Not enough time	*6*	*2*		Focus on key elements of the product, preparation of the steps taken after the project	*8*	
	Training difficult to implement	*8*	*2*		Testing of the product with potential users	*8*	
3	**Market Risk Factors**	7	5	**36**		*8*	**290**
	No need for the product on the market	7	2		Tailor-made dissemination activities	*8*	
	The product does not fit with needs	8	2		Testing of the product with potential users	*8*	

	Difficult to deliver proof of benefit	6	9		Better value definition of products based on this KER	*8*	
	Competition with other methodologies	8	7		Offering free of charge methodology that is available for third parties, including training organisations	*8*	
4	**IPR/legal Risk Factors**	*1*	*2*	**2**		*8*	**16**
	Important IP becomes public	*1*	*2*		Reach an agreement between partners what to disseminate	*8*	
5	**Financial/Management Risk Factors**	*10*	*5*	**50**		*8*	**400**
	Insufficient budget for broad implementation/replication	*10*	*5*		Prepare the sustainability plan, look for other funding	*8*	
6	**Environmental/Regulatory Risk Factors**	*6*	*5*	**30**		*8*	**240**
	Significant differences between countries	*6*	*5*		Focus on core, common content, delivered by the project and standardisation	*8*	

4 Key Exploitable Result 2 – BIMplement Kit: Training Programme

Tailored to the specific needs of building companies.

4.1 Brief Description

The BIMplement kit aims to address the needs and constraints of building companies that wish to train their employees themselves when participating in a project with a BIM process. Blue-collar workers who attend 12 one-hour training sessions will be able to actively participate in an onsite BIM process, that is:

- Understand the impact of a BIM process on the worksite and the role of site staff, including site operators.
- Learn how to handle freeware viewers and to view and analyse the project BIM model using BIM CDE.
- Learn how to find useful information.
- Learn to communicate via notes and documents attached to the model.
- Understand the use of a 4D schedule.

In the end, onsite workers will be able to better understand the project as it has been designed, and therefore, will be able to implement it as close as possible to the design. An important element is that the training content is designed by an in-house trainer (a mentor to the trainees), and this trainer will adapt their training content to the specific project that the trainees are involved in.

4.2 Addressing Problems

The BIMplement kit addresses two conflicting observations made during the BIMplement project implementation:

- For a BIM process to drive maximum improvement on the final quality of the construction, it is essential that all execution phase stakeholders, and especially onsite operators, use the models on the worksite. These are made accessible with freeware viewers and/or collaborative platforms by companies.
- It is difficult to organise and carry out training sessions for site workers, from the site manager to the companions and craftsmen, because of the constraints of the construction site, even if the owner enforces these trainings. One of the major constraints is the difficult mobilisation of companions and craftsmen for a full-day training session in a training centre or onsite.

The BIMplement kit brings the training sessions directly to the construction site, which can be adapted both in terms of content and schedule.

4.3 Unique Selling Point (Competitive Advantage)

The implementation of the BIMplement kit requires a specific training for the trainer, whose programme includes:

- Understanding of the BIM process.
- Manipulation of viewers and collaborative platforms.
- Understanding of the BIMplement pedagogy.

This training for trainers will be implemented by training centres that can also participate in the design of adapted training sessions in collaboration with the company's in-house trainer.

4.4 Service Market and Customer Segments

The major market covers all building companies and training centres as listed in Section 3.4.

4.5 Service Market Size and Trends

The potential social impact is high as the aim is to improve the quality of nZEBs through skills development.

4.6 Product/Service Positioning

BIMplement positions itself as a value-driven (high-level) solution.

4.7 Legal or Normative or Ethical Requirements

Implementation of the solution will depend on legal requirements in the construction sector, especially in terms of energy efficiency, which requires highly trained employees onsite.

4.8 Competitors

Training providers that have proprietary methodologies that address work skills in construction, while using BIM.

4.9 Prospects/Customers and End Users

The needs of Prospects/Customers

Customer	**That needs**
Building and installation companies	• to design, develop and build nZEB, while using BIM • to improve process implementations • to enhance construction quality control process with the use of BIM • to introduce BIM to the company

	• to train its staff (white- and blue-collar workers) on BIM and nZEB
Training providers, learning and (BIM) expertise centres	• to design a training programme for white- or blue-collar workers in the construction sector for upskilling BIM and nZEB skills • to provide training for white- or blue-collar workers in the construction sector for upskilling BIM and nZEB skills • to market BIM and nZEB skills training programmes
Architect chambers	• to raise awareness among architects of quality control aspects in the design process • to increase architects' understanding of the role of other trades in realising quality in relation to architectural design • to promote the use of BIM towards achievement of nZEB quality requirements
Engineers, installers, branches, and associations (HVAC and building services)	• to raise awareness of quality control aspects in engineering, design, and the realisation process • to raise understanding of the role of other trades in realising quality for building services • to scale up upskilling (BIM, nZEB qualification and training requirements)
Technology and material suppliers	• to mainstream application of their product-related knowledge across construction and installer companies • to supply materials and technologies for the building education and training sector
Government agencies	• to promote and/or enforce the use of BIM towards the achievement of nZEB quality requirements in specific territories • to scale up upskilling (BIM, nZEB qualification and training requirements) • to make the playing field more transparent

The needs of end users

As defined in BIMplement D5.6 Implementation service concept' the task-based BIM-linked nZEB training programmes reflect the needs of the end user groups, namely the white- and blue-collar workers. Their needs are addressed by the proposed BIMplement tools and methods through standard or tailored training.

White-collar workers: These are the people working in the office. They are required to plan, design, monitor and inspect systems, effectively and efficiently – to ensure that buildings are airtight and ventilated. They are required to take regulatory requirements into consideration while doing this. White-collar workers include:

- Staff at clients' offices, architects, and project manager teams,
- Building company managers and design teams.

Blue-collar workers: These are the people working at the construction site. They are required to be on-site to complete their job. They also require quick access to quality requirements, tools and instructions. Blue-collar workers include:

- The site manager,
- On-site workers like site operators and craftsmen,
- Foremen.

4.10 Cost of Implementation (Before Replication and Exploitation)

BIMplement was funded under H2020-EU.3.3.7 and H2020-EU.3.3.1 with an overall budget of €999,620.

4.11 Time to Market

The training is ready to go to market.

4.12 Foreseen Product/Service Price

The cost of the BIMplement kit implementation consists of:

- The cost of a training session for the in-house trainer. This training will last between two to five days depending on the initial level of skill and knowledge of the future trainer.
- The time spent by the in-house trainer to adapt the 12 one-hour training sessions to the project the company trainees will be involved in.
- Twelve hours spent by the trainees that take the course, which is included in their working hours, knowing that the training sessions are given directly on the construction site.

4.13 Adequateness of Internal Staff

As a minimum, the in-house trainer needs to be trained on the following:

- Understanding the BIM process.
- The manipulation of viewers and collaborative platforms.
- Understanding the BIMplement pedagogy.

The adaptation of the BIM model to create training content that corresponds to the project may be realised by an external staff member (for instance, a training centre or a design office that is well aware of the BIMplement processes and objectives).

4.14 Involving External Partners

Similarly to KER1, the BIMplement kit requires the involvement of multiple stakeholders. The management staff of the building companies will be most involved with the implementation of the BIMplement kit training programme. The professional branches will also have to be involved and support and encourage site workers to get involved in training that will teach them how to use a BIM model on the construction site for a better implementation of a project. At least one agreement with a BIM expertise or training centre for each BIMplement consortium country has been made to further replicate and exploit both KER1 and KER2.

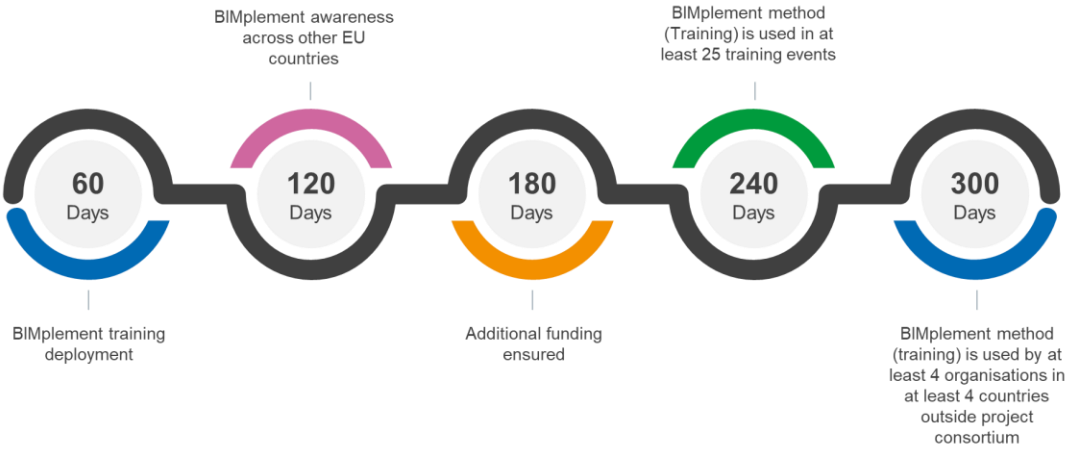
4.15 Status of IPR: Replication and Exploitation Forms

No IPR intellectual property is foreseen, except the obligation to reference the BIMplement source.

4.16 Replication and Exploitation Roadmap

The plan foresees the following KER2 European and national replication and exploitation actions.

Replication and Exploitation Roadmap	
Actions	*The actions required during the 12-month period after project completion:* • To implement BIMplement training at scale (planned numbers are provided in Sections 5.2 and 5.3) • To further prove the effects after use of the BIMplement training Kit • Apply for additional funding (H2020, national governments) to further explore the application of BIMplement training in other areas and countries • Apply the BIMplement training approach to other EU and national projects, as well as topics to further prove its applicability • Further experiment with connecting BIM-models to upskill sources • Communicate the finalised results to member organisations in participating countries (NL, FR, ES, LT) and in other EU countries • Communicate and disseminate applications and lessons learned • Address the EU-wide market, with at least application in Austria, France, Ireland, Spain, and Bulgaria, and in consortium countries • At later phases extend the number of EU countries where the BIMplement training method is applied to >10 The results from BIMplement were made available at the PROF/TRAC website platform. The PROF/TRAC platform is held by REHVA and it gathers training material on several topics related to building energy-efficiency. Most of the stakeholders identified in the ‚D 5.4 Stakeholders map' were also involved in the PROF/TRAC project. Through the BUILDUP platform, several videos, articles about BIMplement project development and results are available - and will be so- even beyond the project lifetime, to key stakeholders. It is worth highlighting the two BIMplement webinars: "How can BIMplement be implemented in other European countries?" and the "Are we ready for BIM in construction sites? A reality check: Experiences from the ground" as part of EUSEW 2020 to which the majority of the stakeholders were invited; Myriam Olivier's participation at the BUP Expert talk video; Jan Cromwijk's participation at the webinar "Renovation wave in Europe how to equip building professionals with future proof skills"; and BIMplement's participation at EUSEW2019 in the session "Upskilling the AEC industry to deliver high-quality energy-efficient retrofitting with BIM learning tools." The latter has involved the majority of the projects that are currently part of BIMAlliance. As partners of BIMAlliance, BIMplement results were shared and used by the BIMzeED project, in which the ACE is a partner, for the development of the Learning Units addressed to construction workers. The BIMplement training material will also be made available at a dedicated open access section (currently under development) of the ACE website, especially addressing European Architects.
Roles	Most of the additional BIMplement method development and implementation (training) activities will be carried out by ISSO, ASTUS, IVE, RIMC, LBA, HIA, LSA, MOSTOSTAL, whereas AVE and ACE will play a leading role in dissemination activities to spread the

	message about the BIMplement method to more countries. ACE will be informed by the training partners of the project, who will organise what training occurs and when and where to invite our national members. Follow-up activities are planned if there are any future trainings for architects organised and ACE members will be invited. Each partner also has an individual approach towards mainstreaming the BIMplement method and training at a national level. For instance, in Spain, training programmes that focus on the Online Catalogue of BIM Objects during the different phases of the construction process will be widely exploited. IVE foresees that the training programmes offered through IVE are linked to the tools offered for professionals.
Milestones	
Revenues	Some of the partners could potentially generate revenue by collecting service fees for the training and related consultancy. Otherwise, the background information for potential users will be free of charge, therefore, the user could potentially generate some revenue by using the BIMplement training approach and materials. The business models for each country are presented in Annex 2.
Other sources of coverage	To maintain the BIMplement kit, some additional sources of funding will be necessary, e.g. partners' own budget, other project grants, national/regional incentives, and also commercial revenues. In France, regulations make it compulsory to train employees.
Impact in 3 years' time	It is expected the results of the project will contribute to the Green Deal goals by reducing CO2 emissions stemming from the construction and exploitation of buildings. It is assumed that triggering BIMplement primary energy savings will constitute ~9735 MWh in three-years' time (based on assumptions described in Section 5).

4.17 Replication and Exploitation: Team and Partner/s' Expectations

The BIMplement kit can be implemented and distributed by each of the BIMplement partners, as well as by each of the training centres they have an agreement with. Table 4 contains a list of partnering organisations with whom agreements are already made, section 5 provides the numbers of planned trainings for each country.

4.18 Replication and Exploitation: Sources of Financing After Project Completion

The BIMplement kit is a new training programme that can be given by training centres. The costs will be supported by the clients and/or support agencies.

4.19 Replicable and Exploitable Result Priority Map

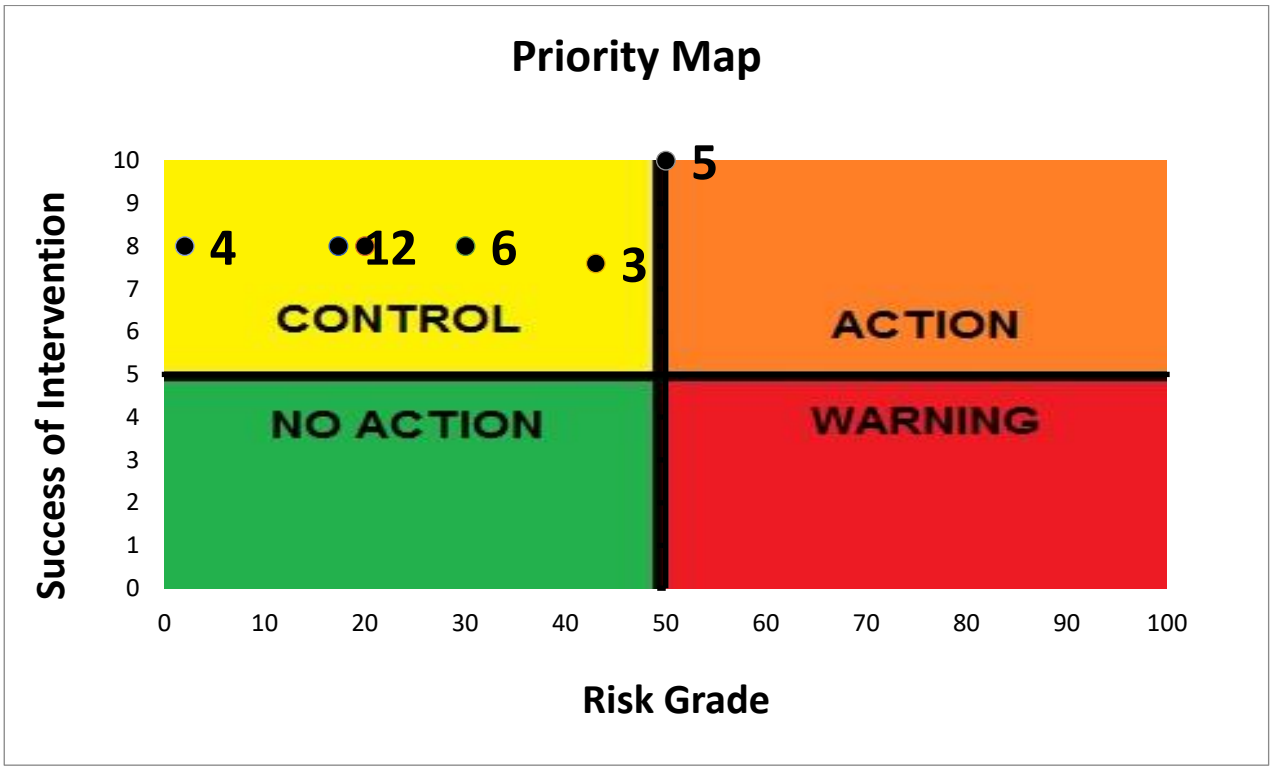


Figure 5: Priority map for KER2

4.20 Risk Matrix

	Key Exploitable Results	Degree of Importance of the Risk Related to the Exploitation of This Key Exploitable Result. Please Rate from 1 to 10 (1=low, 10=high)	Probability of Risk Occurring. Please Rate from 1 to 10 (1=low, 10=high)	Risk Grade	Scope and Type of Potential Intervention	Feasibility/Success of Intervention. Please rate from 1 to 10 (1=low, 10=high)	Priority Level
1	**Partnership Risk Factors**	*9*	*2*	**17**		*8*	**139**
	Insufficient contribution from partners	*10*	*2*		Coordination and regular contacts	*8*	
	Disagreement on IPR	*8*	*2*		Identification of actual background and results, discussions on joint ownership implications	*8*	
	Different expectations/goals	*8*	*2*		Focus on the core, common content delivered by the project	*8*	
2	**Technological Risk Factors**	*10*	*2*	**20**		*8*	**160**
	No clear definition of product	*10*	*2*		Testing of the product with potential users	*8*	
	Not enough time	*10*	*2*		Focus on key elements of the product, preparation of the steps taken after the project	*8*	
	Training difficult to implement	*10*	*2*		Testing of the product with potential users	*8*	
3	**Market Risk Factors**	*9*	*5*	**43**		*8*	**327**
	No need for the product on the market	*10*	*2*		Tailor-made dissemination activities	*8*	
	The product does not fit with needs	*10*	*2*		Testing of the product with potential users	*8*	

	Difficult to deliver proof of benefit	*5*	*5*		Better value definition of products based on this KER	*8*	
	Competition with other methodologies and trainings	*8*	*8*		Make training compulsory if possible	*6*	
	End users have no time for trainings	*10*	*8*		Involvement of key management and HR departments in end users' organisation	*8*	
4	**IPR/legal Risk Factors**	*1*	*2*	**2**		*8*	**16**
	Important IP becomes public	*1*	*2*		Reach an agreement between partners what to disseminate	*8*	
5	**Financial/Management Risk Factors**	*10*	*5*	**50**		*10*	**500**
	Insufficient budget for broad implementation/replication	*10*	*5*		Prepare the sustainability plan, look for other funding	*10*	
6	**Environmental/Regulatory Risk Factors**	*6*	*5*	**30**		*8*	**240**
	Significant differences between countries	*6*	*5*		Focus on core, common content, delivered by the project	*8*	

5 Special indicators to assess the process, outcome, and impact of scaling up

5.1 Objectives and indicators

It is expected that REP will facilitate achievement of the objectives in several ways; these are listed below as defined in note on Task 1.3 and 1.4 Reporting on Impact (BIMplement) *Table 2).

Table 2: Objectives and means of verification

Field of delivery	Project Performance Indicator	Quantification	Measurement unit
Building capacities and skills	Market stakeholders with increased skills/capability/competencies on energy issues **White collar workers:** **Blue collar workers:**	 **710** **752**	Number of people with increased capacity > D4.6
Increased quality and energy performance	Number of new construction and renovation projects engaged in five countries	**49**	Number of new construction and renovation projects engaged in five countries with increased overall quality > D4.6
Increased interaction between different trades and professions enabled by a flexible qualification methodology for integrating technical, cross-trade and BIM related skills and competences into the workplace learning environment	Model nZEB Cross-trade Quality and BIM-Skills Matrix implemented in the 49 projects and used by both medium/senior professionals (architects, engineers) and blue-collar workers (installers, fitters, construction workers).	**236**	Number of companies involved in training programmes in five countries > D4.6
Qualification and training schemes replicated and commercialized after project duration	Collaboration with five national BIM-learning centers established	**5**	Number of agreements reached with BIM-learning centers > D5.5
	Collaboration with PROF/TRAC Platform operational and used by 25 key organizations by the end of the project.	**1.248***	Number of key organizations using PROF/TRAC platform

* This is the total recorded number of users of the PROF/TRAC platform. It was not possible to separate the specific numbers or views for the BIMplement material.
Source: BIMplement D1.2 Report on energy performance indicators.

Estimation of the energy-related impact of the BIMplement project within its duration (Table 3).

Table 3: Energy-related impact

From the data of the involved construction sites, the energy savings achieved by the project within its duration was calculated, following the baseline as follows:

Project Performance Indicator	Quantification	Measurement unit

Energy savings achieved by the project within its duration	**1,517***	Primary energy savings triggered (GWh/year)
Renewable Energy production achieved by the project within its duration (= within quantification energy saving)	-	Renewable Energy production triggered (GWh/year)

Source: BIMplement D1.2 Report on energy performance indicators.

Future impact of the BIMplement results will be ensured through training actions to be undertaken in collaboration with BIM learning centres (in relation to WP5). While implementing WP 5, task 5.5 'Making use of the BIM-learning Centers and/or experts', five co-operation agreements had been made making use of the BIM learning centres in which SME's and enterprises can learn with as little as possible financial barriers (Table 4).

Table 4: List of agreements with BIM learning centres

Country	**Expert centre**
Lithuania	Public Institution 'Digital Construction', https://skaitmeninestatyba.lt/
France	Grands Ateliers Innovation Architecture (GAIA), http://www.lesgrandsateliers.org/ Practee formations, http://www.practee-formations.eu/
Spain	Universitat Politècnica de València (UPV), http://www.upv.es/
Netherlands	BIMpuls, https://www.bimpuls.nl/
Poland	Mostostal Warsawa internal department for HR development, https://www.mostostal.waw.pl/

New trainings for White-Collar and Blue-Collar workers will be implemented, and energy savings, triggered by these trainings, are expected. The planned numbers per country are given in 5.2 'Foreseen trainings after project duration' and 5.3 'Foreseen projects and expected energy savings, triggered by the trainings after project duration'. Trainings are already planned and taking place in project partner countries.

5.2 Foreseen trainings after project duration

Table 5: Future trainings in Spain

Organizers	Action	Expected attendees (per year)	Number of actions
UPV + GVA www.upv.es/	"Master's Degree in building renovation and urban regeneration (Master RERU)": agreement signed	25	1 per year
IVE + GVA	Online training	185	1 per year

Source: BIMplement D1.2 Report on energy performance indicators.

Table 6: Future trainings in the Netherlands

Organizers	Action	Expected attendees (per year)	Number of actions

BIMPulse www.bimpuls.nl/	Integration of BIMplement lessons learned in the training and coaching expertise of BIMPulse	75	1 per year

Table 7: Future trainings in France

Organizers	Action	Expected attendees (per year)	Number of actions
Grands Ateliers Innovation Architecture (GAIA), www.lesgrandsateliers.org	Training of building companies' employees, and of public authorities' staff	20	2/yr
Practee formations, www.practee-formations.eu/	Training of building companies' employees, and of public authorities' staff	40	4/yr
INES, https://www.ines-solaire.org/	Training of building companies' employees, and of public authorities' staff	20	4/yr
DatBIM, www.https://www.datbim.com/	Training of building companies' employees, and of project manager staff	20	4/yr
EFFICITE, efficite.com	Adaptation of the BIMplement Kit to public works	20	1/yr
AFPA, https://www.afpa.fr/	Adult training, through continuing education, and within AFPA training centers	100	2/yr

Source: BIMplement D1.2 Report on energy performance indicators.

Table 8: Future trainings in Lithuania

Organizers	Action	Expected attendees (per year)	Number of actions
Public Institution 'Digital Construction', skaitmeninestatyba.lt/	Public Institution 'Digital Construction', skaitmeninestatyba.lt/ and Lithuanian Builders Association	80	6

Source: BIMplement D1.2 Report on energy performance indicators.

Table 9: Future trainings in Poland

Organizers	Action	Expected attendees (per year)	Number of actions
Mostostal Warsawa internal department for HR development, www.mostostal.waw.pl/	Preparation of an e-learning platform for Mostostal employees and subcontractors to perform on-line trainings	150	Ongoing in the internet

Source: BIMplement D1.2 Report on energy performance indicators.

5.3 Foreseen projects and expected energy savings, triggered by the trainings after project duration

Table 10: Future energy savings in Spain

Action	Expected participants (per year)	Number projects per year	Size (m2)	Predicted energy performance	Estimated performance gap (% of predicted	Reduction of building intrinsic factors due	BIMplement primary energy savings

				(kWh/m2.year)	energy performance)	to BIMplement training (%)	triggered (MWh/year)
"Master's Degree in building renovation and urban regeneration (Master RERU)": agreement signed	25*	1 renovation	1000	115	100	4	115
		1 new construction	1000	18	100	4	18
						TOTAL	133

Source: BIMplement D1.2 Report on energy performance indicators. This estimation is based on the numbers of participants in future trainings where BIMplement results will be included, and estimating that each of the participants will apply the knowledge acquired, at least, in 1 renovation project and in 1 new construction project per year.

Table 11: Future energy savings in the Netherlands

Action	Expected participants (per year)	Number projects per year	Size (m2)	Predicted energy performance (kWh/m2.year)	Estimated performance gap (% of predicted energy performance)	Reduction of building intrinsic factors due to BIMplement training (%)	BIMplement primary energy savings triggered (MWh/year)
Training and coaching expertise of BIMPuls	15	1 renovation	1000	115	100	4	86
		1 new construction	1000	15	100	4	9
						TOTAL	95

Source: BIMplement D1.2 Report on energy performance indicators.

Table 12: Future energy savings in France

Action	Expected participants (per year)	Number projects per year	Size (m2)	Predicted energy performance (kWh/m2.year)	Estimated performance gap (% of predicted energy performance)	Reduction of building intrinsic factors due to BIMplement training (%)	BIMplement primary energy savings triggered (MWh/year)
BIMplement training	100	5 renovation	1000	115	100	4	2300
		1 new construction	1000	50	100	4	200
						TOTAL	2500

Source: BIMplement D1.2 Report on energy performance indicators.

Table 13: Future energy savings in Lithuania

Action	Expected participants (per year)	Number projects per year	Size (m2)	Predicted energy performance (kWh/m2.year)	Estimated performance gap (% of predicted energy performance)	Reduction of building intrinsic factors due to BIMplement training (%)	BIMplement primary energy savings triggered (MWh/year)
BIMplement training	80	1 renovation	1000	70	100	4	224
		1 new construction	1000	30	100	4	96
						TOTAL	320

Source: BIMplement D1.2 Report on energy performance indicators.

Table 14: Future energy savings in Poland

Action	Expected participants (per year)	Number projects per year	Size (m2)	Predicted energy performance (kWh/m2.year)	Estimated performance gap (% of predicted energy performance)	Reduction of building intrinsic factors due to BIMplement training (%)	BIMplement primary energy savings triggered (MWh/year)
BIMplement training	150	1 renovation	15000	115	100	4	69
		4 new construction	80000	18	100	4	128
						TOTAL	197

Source: BIMplement D1.2 Report on energy performance indicators.

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6 Annexes

6.1 Annex 1 Replicable and Exploitable Foreground and its Use

The rights and obligations related to background and results are stipulated in Section 3 of the Grant Agreement (745510).

Description of Replicable and Exploitable Foreground	Replicable and Exploitable Results	Sector(s) of Application	Time to Market	Patents or Other IPR Replication and Exploitation Forms/Claims	Owner and Other Beneficiary(s) Involved
Shared IPR	Methodology for a BIM-enhanced Qualification Framework	Construction, education	Market ready	Copyrights	Partners participating in the development
Shared IPR	Tailor-made training programme	Construction, education	Market ready	Copyrights	Partners participating in the development

6.2 Annex 2 Business Models

The main objective of the business model is to identify business opportunity and concept for commercialisation of the services developed during the BIMplement project. The prototypes of qualification methodology (KER1) and training programmes (KER2) have been created and tested on multiple construction sites. The successful proof of concept is validated by examples provided by different consortium partners. For the purpose of further refinement of the replication and exploitation potential, the canvas model developed by A. Osterwalder is used. The canvas helps to move beyond product-centric thinking towards business model thinking.[3] Alternative business models involving private and public sector players were explored, while reflecting on different approaches enjoyed by different partners at a national and international level.

3 A.Osterwalder (2013), 'A Better Way to Think About Your Business Model', Harvard Business Review, May 06, 2013, https://hbr.org/2013/05/a-better-way-to-think-about-yo

Business Model Canvas (EU)

Key Partners

- EU-consortia working on H2020 construction skill projects
- Umbrella organisations ACE and REVHA

Key Activities

- Providing open access
- Consultancy

Key Resources

- BIMplement QF
- BIMplement KIT

Value Proposition

- Solid, fast and flexible method for task-based qualifications
- Fast insight in BIM-maturity and upskilling possibilities
- Creating cross-craft collaboration and understanding
- Improving the quality of work on nZEB's

Customer Relationships

- Enabling other organisations to implement and extend BIMplement key exploitable results

Channels

- PROF/TRAC platform
- BUILD UP
- BIMplement website

Customer Segments

- BIM trainers and coaches
- Umbrella organisations at EU level
- Educational technologists working on qualifications

Cost Structure

- Staff costs, software costs, marketing costs, expert costs

Revenue Streams

- Consultancy on creating qualifications with the BIMplement QF
- Training of the BIMplement coaches and independent consultants
- New projects

Template designed by: Business Model Foundry AG

Business Model Canvas (Spain)

Catalogue of BIM objects for nZEB (and related tools)

Key Partners

- Regional Government of Housing and Public Works
- Manufacturers' associations
- Professionals' Associations (construction companies, installers, etc.)
- BIM software providers
- Valencian BIM group

Key Activities

- Detection of needs
- Development of BIM objects
- Revision and validation by external parties
- Communication & Dissemination

Key Resources

- Human resources
- Software

Value Proposition

Improving a harmonised quality of the built environment by helping professionals (white and blue collars) in their work

Customer Relationships

- At least 4 open events
- Loyalty

Channels

- Social Media
- Newsletters
- Website
- Online shop

Customer Segments

Professionals: design offices and construction companies, municipal technicians

Cost Structure

- Staff costs, software costs, marketing campaigns, graphic design, indirect costs

Revenue Streams

-Grants from Regional Government, product sales (pack subscription, etc.)

Template designed by: Business Model Foundry AG

Business Model Canvas (Netherlands)

Key Partners

- Training institutes
- BIM consultants and coaches
- Educational sector (EQF4-7)
- Branch organisations

Key Activities

- Consultancy
- Train-the-trainer of BIM trainers and coaches
- Web-based BIM-

Key Resources

- Qualification methodology and ULO database
- Task based BIM maturity scan

Value Proposition

- Solid, fast and flexible method for task-based qualifications
- Fast insight in BIM-maturity and upskilling possibilities
- Creating cross-craft collaboration and understanding
- Improving the quality of work in the area of airtightness and ventilation

Customer Relationships

- Enabling other organisations to deliver BIM training & coaching
- Creating a level plain field for improved collaboration

Channels

- Branch organisations
- Digideal Built Environment
- Training institutes

Customer Segments

Through BIMplement coaches and trainers consequently:

- Construction companies
- Installation companies
- Self-employed professionals and blue collars

Cost Structure

- Consultants
- Software development & Service License Agreement
- Extension of the task-based BIM maturity scan

Revenue Streams

- Use of the BIM maturity scan (pay per scan)
- Consultancy on creating qualifications with the BIMplement QF
- Training of the BIMplement coaches and independent consultants

Template designed by: Business Model Foundry AG

Business Model Canvas (France)

Key Partners

- REGIONS
- ORCA (organisation to collect and manage training funds)
- State administration

Key Activities

Finding workplaces and BIM coaches

Key Resources

BIM coaches

Value Proposition

1. Increase competences of training organisations and their market
2. Increase competences of local authorities
3. Increase competences of local workforce
4. Improve the quality of buildings
5. SME access to markets

Customer Relationships

Participation in national committees
Policy development

Channels

Website
Social media
E-newsletters

Customer Segments

- Training organisations
- SMEs and professional bodies
- Local authorities

Cost Structure

Staff costs, administrative costs, marketing costs

Revenue Streams

Public money (including social funds)
Private money (SMEs, ORCA)

Template designed by: Business Model Foundry AG

Business Model Canvas (Lithuania)

Key Partners

- Digital Construction (DIGCON)
- Associations (architects, engineers, contractors)
- Suppliers
- Training organizations
- Integration, Interoperability (IT infrastructure solutions (CDE))

Key Activities

- Training
- Consulting
- Competence registry

Key Resources

Consultants, external experts, partners network

Value Proposition

1.Clarification of BIM NZEB process for White and Blue Collars.
2.Presenting right information, at right time for Blue Collars for installation of technologies.
3.Verification of quality.
4.Checking of correct installation technology process.
5.Speed up and Transparency of control of the delivered work.
6.Automation possibilities (for integration part).
7.Improvement of Health and safety measures

Customer Relationships

Meetings
Conferences
Websites

Channels

Online
Direct contacts

Customer Segments

- Construction contractors
- Design Companies
- Manufacturing companies
- IT companies

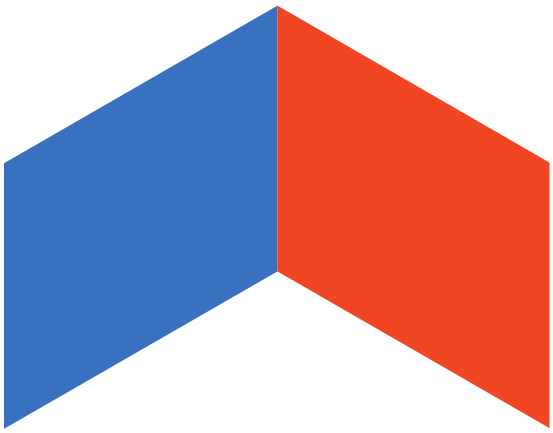
Cost Structure

Staff cost, IT costs, facilities, marketing costs

Revenue Streams

Training Fees, membership fees, consultancy fees

BIMplement



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