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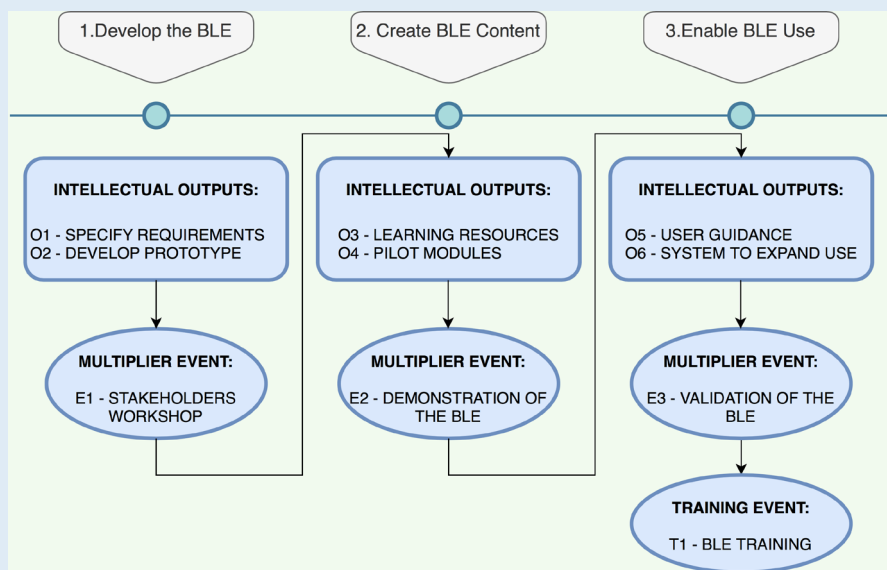
Looking ahead

**WELCOME TO THE BENEDICT PROJECT!**

Building Information Modelling (BIM) refers to the digital representation of buildings and construction operations and the BENEDICT (BIM-enabled Learning Environment for Digital Construction) project is an Erasmus+ Strategic Partnership aimed at leveraging BIM to enhance education and training in the Real Estate and Construction (REC) sector. To achieve this, BENEDICT brings together researchers from three universities: Tallinn University of Technology (Estonia), Tampere University (Finland) and the University of Bologna (Italy) with collaborating organisations in all three countries to develop an innovative, BIM-enabled Learning Environment that will offer more realistic, immersive and integrated learning experiences.

**BENEDICT PROJECT LOGIC**

The project is organised into six Intellectual Outputs together with 3 Multiplier Events and 1 Training Event as shown in the figure:



**FIGURE 1 - PROJECT LOGIC**





## PROJECT BACKGROUND AND PROGRESS – EDITORIAL

The Benedict project grew out of my postdoctoral research under the supervision of Kalle Kähkönen (Tampere University) into how the virtual BIM environment could be leveraged to improve construction management education. The broader aim of that research was to foster a new generation of 'BIM natives' who can 'think in BIM' in order to realize the full potential of BIM for industry as well as capturing emerging opportunities for education and training, research and development. It culminated in conceptualising a BIM-enabled Learning Environment in which learners could engage in industry-realistic educational or training activities within a supportive, experiential learning space. In the spring of 2020, on the suggestion of Kalle Kähkönen and with the collaboration of Marco Alvise Bragadin of the University of Bologna, we put together an Erasmus + strategic partnership project proposal to develop the BIM-enabled Learning Environment (BLE). Our proposal successfully secured funding and the Benedict project began in September 2020.

During the first year of project implementation, the focus was on setting up the project and specifying the requirements for the BLE in detail. Currently, in April 2022, we are building the prototype BLE as well as developing pilot course modules for demonstrating it and compiling the learning resources (case study project models and data) needed to support these pilot modules. In this, our first project newsletter, we would like to share the results of our work so far on defining the BLE requirements (next article), celebrate our first face-to-face meeting that took place in Tampere in January (page 6) and look ahead to the project-related activities and events that are coming up in the next few months (page 7).

**Emlyn Witt - Project Coordinator (TalTech)**

### PROJECT PARTNER ORGANISATIONS

#### CONTACTS

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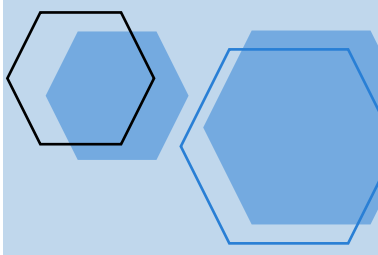
TALLINN UNIVERSITY OF TECHNOLOGY, ESTONIA



TAMPERE UNIVERSITY, FINLAND



UNIVERSITY OF BOLOGNA, ITALY



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# THE BIM-ENABLED LEARNING ENVIRONMENT SPECIFICATION

Researchers at Tallinn University of Technology, Tampere University and the University of Bologna are currently developing a BIM-enabled Learning Environment (BLE) with the intention of providing realistic, immersive and integrated learning experiences. The first stage of this development involved specifying the BLE requirements and these requirements can be considered in three categories as follows:

- The general requirements or principles that guide the development of the BLE.
- The functionalities that users (learners, instructors, administrators) would need for BIM-enabled learning activities.
- The technical solutions that would enable the identified functionalities.

## GENERAL PRINCIPLES

The principles guiding the development of the BLE are that it must be:

- Open - so that participation in BIM-enabled learning is accessible to everyone and does not depend on the specific software tools that they use.
- Compatible - the BLE must be compatible with different systems, approaches and requirements for widespread use.
- Accessible - in both the senses of:
  - enabling public access;
  - it being user-friendly and easy to use.
- Replicable - the BLE must be fully documented so that others can easily replicate it and/or develop alternatives to it.
- Inclusive - so that it can address the learning needs of all professions in the real estate and construction (REC) sector.
- Scalable - so that it can be extended to REC sector-wide use.



## FUNCTIONAL REQUIREMENTS

The functionalities needed by BLE users were found by analysing existing BIM-enabled learning activities in the partner universities and conducting 31 interviews with REC sector stakeholders in all three partner countries. The list of required BLE functionalities was finalised and validated in an online stakeholders' workshop involving experts from 5 countries hosted by Tampere University in June 2021. The identified functional requirements fall into 3 categories - those associated with: 1. Learning Management Systems, 2. Collaboration Platforms, and 3. BIM solutions - as shown below in Tables 1-3.

**TABLE 1 - LEARNING MANAGEMENT SYSTEM FUNCTIONS**

Solution Type	Functional Requirements
Learning Management Systems (LMS), e.g. Moodle	Hosting of different courses
	Registration of users (learners / instructors)
	Data security / password protection
	Linking to extra learning materials
	Individual learners' storage for learning materials
	Questionnaire creation, completing, submission, analysis
	Assessment / grading functions - grade entering for individuals / groups, grade book
	Student feedback
	Group formation
	Video playback
	Gamification support functions
	File upload, storage, download, sharing, editing
	Instructor access and monitoring of groups and group work
	Collaboration in groups
	Collaboration between groups
	Live interactions between users
	Recording of group sessions and lessons
BIM model sharing	
Repository of example BIM models	

**TABLE 2 - COLLABORATION FUNCTIONS**

Solution Type	Functional Requirements
Collaboration platforms, e.g. Office 365	File upload, storage, download, sharing, editing
	Instructor access and monitoring of groups and group work
	Collaboration in groups
	Collaboration between groups
	Live interactions between users
	Recording of group sessions and lessons
	Collaborative viewing and editing of documents and spreadsheets
	Common Data Environment (CDE) for project data



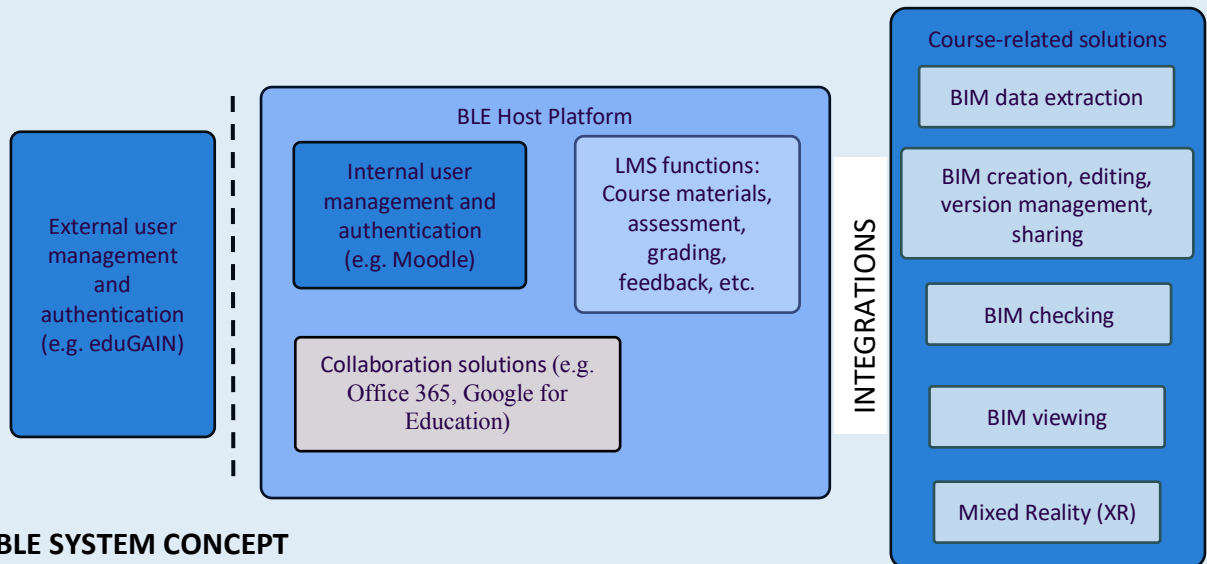
**TABLE 3 - BIM FUNCTIONS**

Solution Type	Functional Requirements
BIM solutions, e.g. model viewer	BIM model sharing
	Repository of example BIM models
	Common Data Environment (CDE) for project data
	BIM model viewing
	BIM model data extraction
	BIM model version management
	BIM model checking
	BIM model editing
	BIM model collaborative viewing and editing
	BIM model creating
	BIM object creation and editing
	Extended reality (XR) functions: AR/MR/VR

**TECHNICAL SOLUTION AND DESIGN CONCEPT**

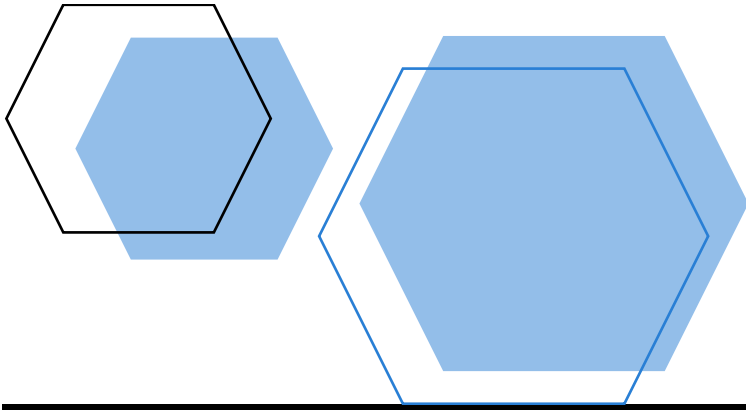
The resulting, validated functional requirements were then presented to technical experts at each of the partner universities for recommendations of how these functions could be technically delivered in the context of a BLE. Analysis of their feedback suggested a system design comprising a host platform based on a Learning Management System (LMS) installation with additional collaboration tools and further integrations with (open) BIM solutions to enable course-specific BIM functionalities as shown in Figure 2.

**BIM-ENABLED LEARNING ENVIRONMENT SYSTEM DESIGN CONCEPT**



**FIGURE 2 - BLE SYSTEM CONCEPT**

A journal paper related to these findings and co-authored by Theophilus Olowa (TalTech), Emlyn Witt (TalTech), Caterina Morganti (University of Bologna), Toni Teittinen (Tampere University), and Irene Lill (TalTech) was published in January 2022: Olowa, et al. (2022) "Defining a BIM-Enabled Learning Environment—An Adaptive Structuration Theory Perspective" Buildings 12, no. 3: 292. <https://doi.org/10.3390/buildings12030292>



## FIRST FACE-TO-FACE PROJECT MEETING

TAMPERE 17-18<sup>TH</sup> JANUARY 2022

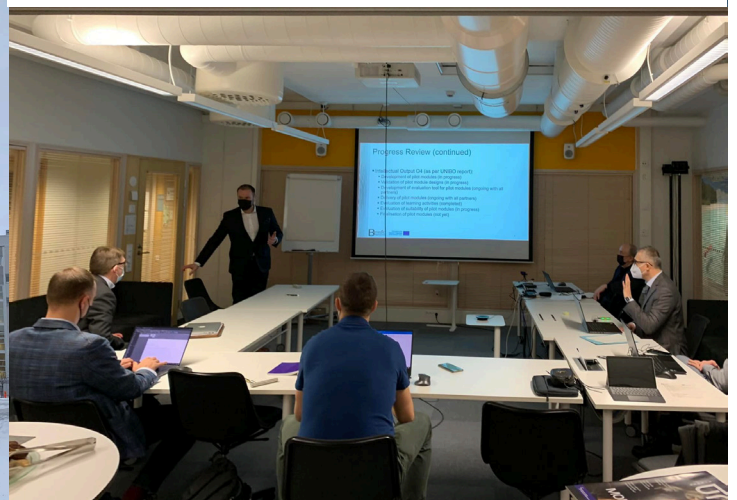
For the first time since the beginning of the project, the project team was able to meet face-to-face for the 3rd Project Progress Meeting held on the 17th and 18th of January 2022 in Tampere, Finland. Having held all previous project events online as a consequence of COVID travel restrictions, this was a very welcome change and it came at an opportune time - almost half-way through the project's 3-year funding period with 3 key intellectual outputs (O2-BLE Development, O3-Learning Resources, O4-Pilot Modules) all at a formative stage in their progress.



PROJECT TEAM



UNIBO TEAM AT THE HERVANTA CAMPUS OF TAMPERE UNIVERSITY



PROJECT MEETING

Thanks to the outstanding organisation of our hosts, Kalle Kähkönen and his team, we were fully able to navigate all the COVID restrictions in place and, in addition to coordinating the Benedict project work, the project team enjoyed a tour of the Hervanta campus of Tampere University and were treated to an excellent dinner prepared from fine northern Finnish ingredients at the Dabbal Kitchen & Bar restaurant.



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## LOOKING AHEAD

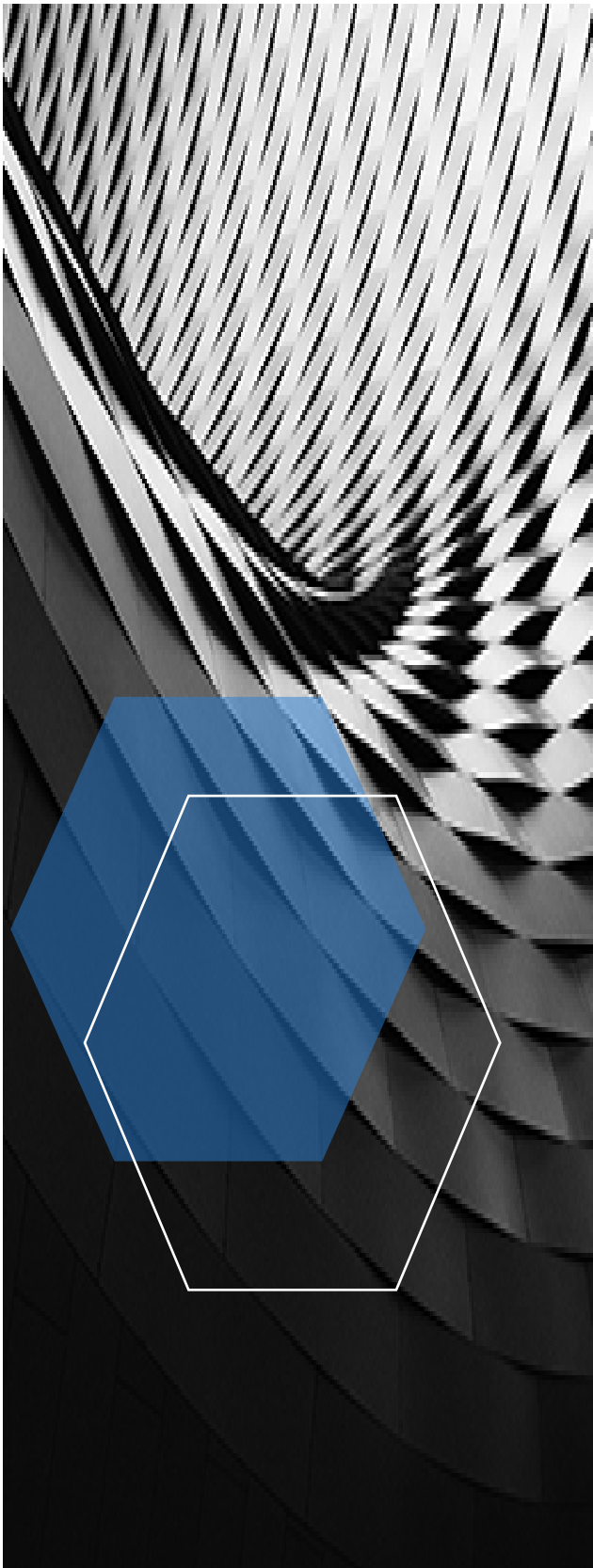
### MAY

A Benedict project paper reporting the findings of Intellectual Output O1 - Specification of the BLE will be presented to the 11th Nordic Conference on Construction Economics and Organisation which will take place on 19-20 May 2022 in Copenhagen and Malmö. The paper is entitled: *Defining Requirements for a BIM-enabled Learning Environment* and is co-authored by the team leaders of all three partner universities - Emlyn Witt (TalTech), Kalle Kähkönen (Tampere University) and Marco Alvisè Bragadin (University of Bologna).

### JUNE

The prototype BLE platform will be demonstrated for the first time to stakeholders including students, teachers, programme directors and industry representatives at a multiplier event to be held at Mektory on the TalTech campus in Tallinn on the 2nd of June 2022. In conjunction with this event, a transnational project meeting (the 4th project progress meeting) will take place on the 3rd of June 2022.

A Benedict project paper reporting the development of evaluation tools for the pilot modules being developed under Intellectual Output O4 - Pilot Modules will be presented to the 18th CDIO International Conference which will be held in Reykjavik, Iceland from 13-15th June 2022. The paper is entitled: *Evaluation of Immersive Project-Based Learning Experiences* and is co-authored by Tiia Rütmann, Emlyn Witt, Theophilus Olowa (all of TalTech), Taija Puolitaival (Tampere University) and Marco Bragadin (University of Bologna).



**Benedict**  
BIM-enabled Learning Environment for  
Digital Construction

## ASSOCIATE PARTNERS

ESTONIA

**EHITUSKESKUS**

Ehituskeskus (Construction Centre)

Novarc Group AS



FINLAND

RIL (Finnish Association of Civil Engineers)



BuildingSMART Finland



ITALY

Istituto Istruzione  
Professionale Lavoratori Edili  
(Building school)



CMB Societa Cooperativa Muratori e Braccianti di Carpi



Associazione Italiana di Ingegneria Economica (Certified  
Cost Engineers Society)



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