

INSIDE THIS ISSUE

Page 1

Looking Back over the
Benedict Project and its
Achievements

Page 4

The Joint Staff Training
Event held at Taltech in
June 2023

Page 8

Looking Ahead beyond
the Benedict Project
Funding Period

LOOKING BACK OVER THE BENEDICT PROJECT AND ITS ACHIEVEMENTS

When the Benedict project began in September 2020, we were in the grip of the COVID-19 pandemic. While this did not prevent us from carrying out project activities (which had been designed with pandemic restrictions in mind), it did create 2 distinct phases for the project – from September 2020 to December 2021 during which all activities took place online and from January 2022 to August 2023 when face-to-face interactions were again possible. The first, online phase was dominated by putting in place the project’s administrative structures, establishing the team and developing the core concepts of the project. These concepts were then demonstrated and applied in the second phase which, conveniently, benefited from the enhanced collaboration and interactions made possible by the resumption of opportunities to meet physically.

BENEDICT PROJECT ACTIVITIES

The project activities followed a simple logic – step 1: developing a BIM-enabled Learning Environment (BLE), step 2: creating content for it and then step 3: enabling people to use it (see Figure 1). These steps were achieved through six intellectual outputs, 3 multiplier events and a joint staff training event.

Intellectual Output (IO) 1 was led by TalTech and focused on specifying the requirements for the BLE based on interviews carried out with 31 relevant professionals from all 3 partner countries as well as the collective experiences of the three project partner universities. The first multiplier event – Stakeholders Workshop – held in June 2021 and hosted (online) by Tampere University brought together 27 experts from 5 countries to discuss and finalize the requirements for a BLE.



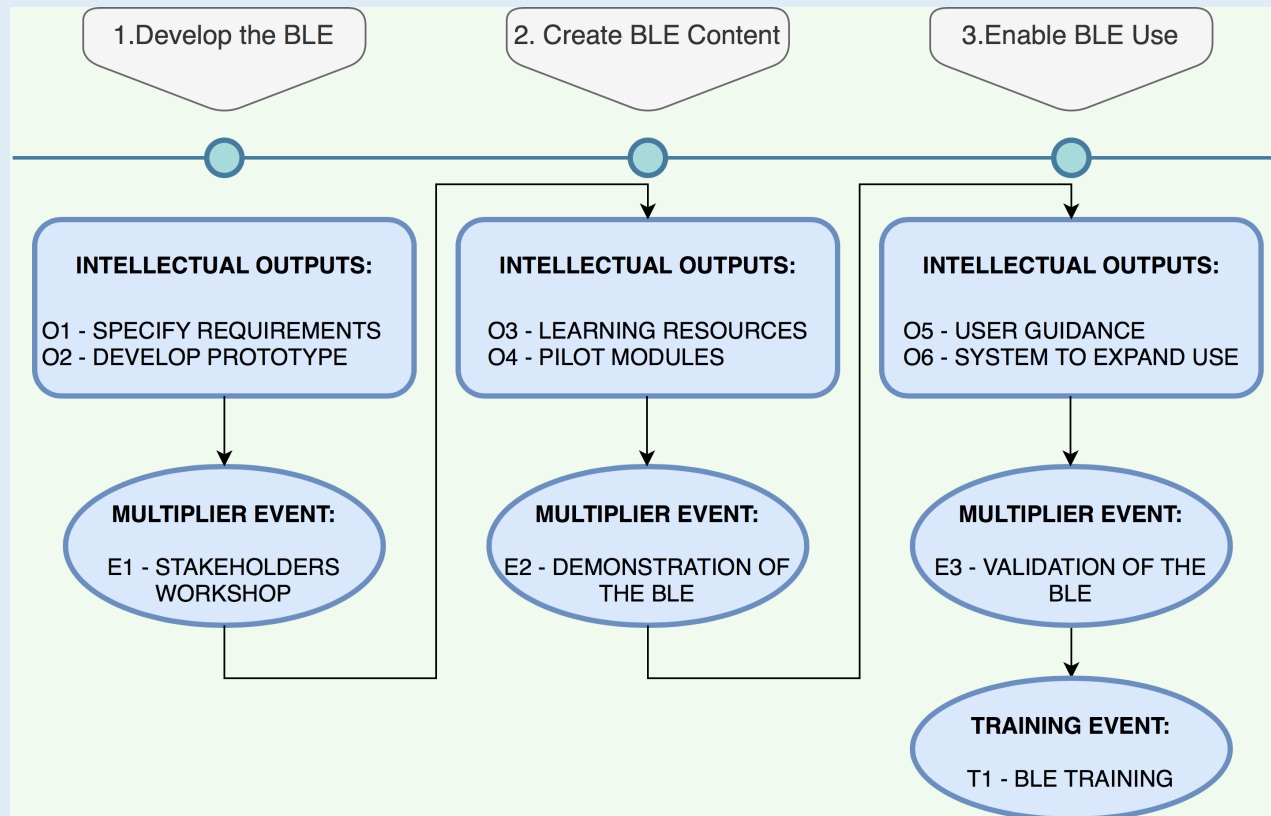


FIGURE 1 - PROJECT LOGIC

Tampere University led the team on IO2 to develop the IO1 findings into a workable BLE prototype. This took the form of a custom Moodle installation with integrated functions enabling the convenient use of BIM models in the learning process. Together with BLE content developed under 2 intellectual outputs led by the University of Bologna in relation to learning resources (IO3) and pilot modules on Design Management, Time Management and Risk Management (IO4), the prototype BLE platform was demonstrated to 29 stakeholders from education and industry at Multiplier Event 2 – Demonstration of the BLE - held in Tallinn in June 2022. A follow-up event, also held in Tallinn in October 2022, extended the audience to include academics representing a further 7 higher education institutions from 3 countries (Lithuania, Sri Lanka, United Kingdom).

Between September 2022 and April 2023, the pilot modules were delivered to student groups at all 3 of the partner universities. In all cases, the students' and teachers' feedback confirmed that students found these modules to be informative, useful, interesting and engaging learning experiences that allowed them to learn a lot about the module topics within a BIM-enabled context.

The third and final multiplier event was held in March 2023 in Bologna, Italy and hosted by the University of Bologna. It aimed to validate the BLE by introducing its concepts and functionalities to a broad range of stakeholders and discussing with them the opportunities and challenges for BIM-enabled learning. The event attracted 52 participants from industry, professional associations, vocational training centres and academic institutions.

Intellectual Outputs O15 (guidance materials) and O16 (system to expand use) both focused on extending the use of the BLE. Guidance materials were produced in all three local languages (Estonian, Finnish, Italian) as well as the project language (English) to enable stakeholders to fully



access and use all aspects and functions of the BLE as well as providing course manuals for all 3 of the pilot modules. The system to expand the use of the BLE has drawn on all the results of the discussions that took place at the multiplier events as well as a questionnaire survey of 72 expert respondents across the 3 partner countries to form a comprehensive understanding of how to take forward the BLE into widespread use.

The project culminated in the Joint Staff Training Event held in Tallinn in June 2023. This served as an opportunity to entrench BIM-enabled learning through the use of the BLE in the partner institutions and throughout the Real Estate and Construction (REC) sector. The training focused on imparting a comprehensive understanding of the BIM-enabled learning concept and enabling trainees to fully utilise the BLE (together with its content) to support their teaching and training activities. (See the next article for a more detailed description of this event).

COLLABORATIONS

The Benedict project was funded under the Strategic Partnerships in Higher Education initiative within the Erasmus+ Programme of the European Union and, in this context, it is important to stress the close collaboration between the 3 partner universities that have been fostered during the project. In carrying out the project activities themselves, we have become familiar with each others' learning and teaching environments, teaching methods and study administration arrangements. We have directly investigated the similarities and differences in our learning management and other information systems that are in use at our institutions – their relative advantages and the challenges they bring with them. In collaboratively designing the pilot content for the BLE and deriving assessment and evaluation tools for BIM-enabled learning, we have learned a lot from each other and grown closer in our collective understanding of meaningful learning experiences.

In addition to the expected collaboration in project activities and events, we have also leveraged our project-related cooperation to further engage with each other – in student exchange visits (for example, a University of Bologna masters student and a doctoral student from TalTech had study visits to Tampere University), in guest lectures to each others' students and participation in a doctoral defence commission.

PUBLICATIONS

In addition, we have collaborated closely in research and co-authored publications relating to the project results. Numerous project-related research papers have been published by the partners, most notably, 1 journal paper and 4 conference papers with co-authors from all 3 partners have been published (list below) and a further conference paper has been accepted for presentation / publication while a second journal paper in relation to IO6 is currently under development.

Journal publications with co-authors from all 3 partners

Olowa, T.; Witt, E.; Morganti, C.; Teittinen, T.; Lill, I. (2022). Defining a BIM-Enabled Learning Environment—An Adaptive Structuration Theory Perspective. *Buildings*, 12 (3), 292. DOI: 10.3390/buildings12030292.



Conference papers with co-authors from all 3 partners

Morganti, C., Coraglia, U. M., Bragadin, M. A., Rissolo, D., Witt, E., & Kähkönen, K. (2023, July). Teaching BIM: a comparison between actual and future perspectives. In EC3 Conference 2023 (Vol. 4, pp. 0-0). European Council on Computing in Construction.

Bragadin, M. A., Morganti, C., Coraglia, U. M., Kähkönen, K., & Witt, E. D. Q. (2022). Simulazione 4D BIM del cantiere per il progetto BENEDICT/BIM 4D construction site modelling for the BENEDICT project. In Memoria e Innovazione/Memory and Innovation (pp. 761-773). EdicomEdizioni.

Witt, E.; Kähkönen, K.; Bragadin, M. (2022) Defining Requirements for a BIM-enabled Learning Environment, in Proceedings of the 11th Nordic Conference on Construction Economics and Organisation, 18-20 May 2022 in Copenhagen and Malmö, Aalborg University (pp. 237-250). Cham: Springer International Publishing.

Rüütman, T., Witt, E., Olowa, T., Puolitaival, T., Bragadin, M. (2022). Evaluation of immersive project-based learning experiences. In: M. S. Gudjonsdottir, H. Audunsson Arkaitz, M. Donoso, G. K. Ingunn Saemundsdóttir, J. T. Foley, M. Kyas, A. Sripakagorn, J. Roslöf, J. Bennedsen, K. Edström, N. Kuptasthien, R. Lyng (Ed.). 18th CDIO International Conference, 13-15 June 2022, Reykjavik University, Iceland. Proceedings - Full Papers. (313-323). CDIO Initiative.

I would like to take this opportunity to personally thank all the members of the project team for all their hard work and dedication in bringing the Benedict project to a successful conclusion!

Emlyn Witt - Project Coordinator (TalTech)

THE JOINT STAFF TRAINING EVENT HELD AT TALTECH IN JUNE 2023

The final international event for the Benedict project, a short-term joint staff training course with the aim of training staff to use the BIM-enabled Learning Environment (BLE) took place over three days from the 19th-21st June 2023 at the TalTech campus in Tallinn. This intensive training activity was an opportunity to entrench BIM-enabled learning through the use of the BLE in the partner institutions and beyond, within the Real Estate and Construction (REC) sector. The training focused on ensuring that trainees understand the BIM-enabled learning concept and are able to fully utilise the BLE (together with its content) to support their teaching and training activities. In addition, it served to raise the profile of the Benedict project and its primary deliverable, the BLE, and encourage interest in taking forward BIM-enabled learning and the BLE beyond the project funding period.

Day 1 of the training focused on the pedagogical aspects of BIM-enabled learning and project-based learning and it took place in the Suzhou Garden room of the TalTech Innovation and Business Centre Mektory. After a review of the Benedict project and its key principles in relation to BIM-enabled learning, Tiia Rüütman of the Estonian Centre for Engineering Pedagogy



presented developments of the BIM-enabled learning concept, its evaluation and assessment that had resulted from Benedict project development work.



FIGURE 2 – PRESENTATIONS ON DAY 1 OF THE TRAINING



FIGURE 3 – TOUR OF E HITUSE MÄEMAJA, TALTECH CAMPUS



Invited speakers from TTK University of Applied Sciences (Olga Ovtšarenko) and TalTech (Raivo Sell and Raimond Vink) presented their experiences and results from projects, programmes and courses in relation to BIM-enabled and project-based learning approaches instigating rich discussions and knowledge sharing on these approaches which spanned the lunch break. International delegates were given a guided tour of Ehituse Mäemaja – TalTech’s most energy efficient educational and research building.

Day 2 of the training focused on technological aspects, specifically, hands-on demonstrations of the BLE and its associated systems – the Open Learning Resources repository and the mixed reality possibilities in BIM-enabled learning. This training took place in the dedicated lab in which specialized equipment to enhance the BLE experience have been installed (including a video matrix screen and virtual reality demonstration equipment). In addition, related projects (EduBIM presented by Martin Thalfeldt) and recent educational technology developments at the University of Bologna and at Tampere University were presented and discussed. A guided tour of the Education Technology facilities of TalTech was given to delegates.



FIGURE 4 – PRESENTATION ON DAY 2 OF THE TRAINING

Day 3 was held in the Green Energy Hub of the TalTech Innovation and Business Centre Mektory and focused on workshopping the future of BIM-enabled learning and sustaining the Benedict project achievements beyond the funding period. Specific workshops were held on finalising guidance materials for the BLE, the system for sector-wide expansion of the BLE concept, and sustainability planning for the BLE.





FIGURE 5 – TOUR OF THE TALTECH EDUCATION TECHNOLOGY FACILITIES



FIGURE 6 – WORKSHOP ON DAY 3 OF THE TRAINING



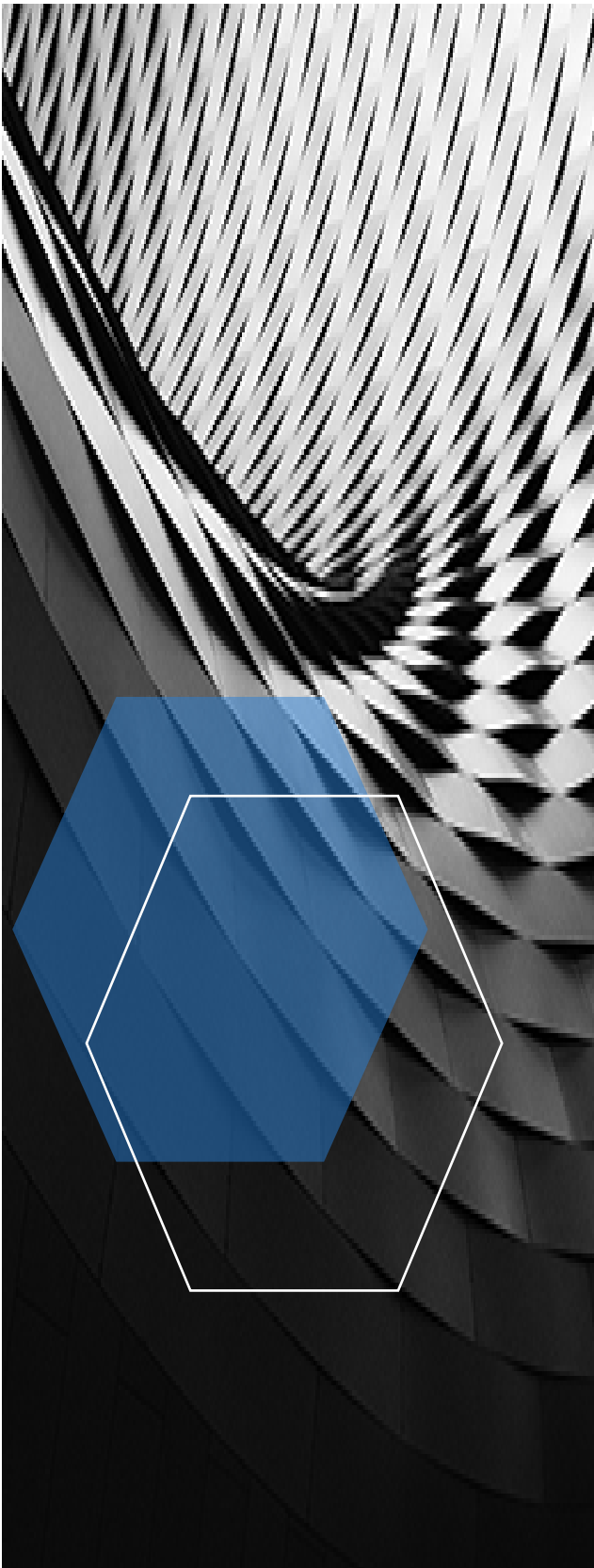
In all, a total of 18 delegates attended the training. Beyond staff from all three partner universities directly linked to the project, delegates included REC industry representatives as well as programme directors, teaching staff and students from TalTech and TTK University of Applied Sciences.

LOOKING AHEAD BEYOND THE BENEDICT PROJECT FUNDING PERIOD

While the funding period for the Benedict project is now at its end, the BIM-enabled Learning Environment (BLE) concept, prototype BLE platform and the pioneering work to leverage BIM to enhance learning processes in the Real Estate and Construction sectors of Estonia, Finland, Italy and beyond have just been established and are all set for further development. In the last months of the project, particular attention was placed on planning for the sustainability of the project's impacts. A Sustainability Plan was developed with the aim of ensuring that key outcomes of the BENEDICT project are maintained and expanded beyond the funding period. The project team collaboratively agreed the priorities in terms of what project aspects should be sustained, who would take responsibility and where the resources to do sustain them would be sourced. This resulted in the following list of sustainability actions:

- The project website will continue to be online and maintained.
- Contact persons will continue to be available in each partner institution.
- The BIM-enabled Learning Environment (BLE) platform will be maintained and developed.
- The Open Learning Resources (OLR) repository will be maintained and developed.
- The pilot modules and other learning content developed within the project will continue to be used and integrated into learning programmes at the partner institutions.
- Partners will continue to advocate for BIM-enabled learning.
- Further project proposals will be developed – building on from the work of BENEDICT and utilizing and developing the BLE platform and OLR repository.
- Research collaboration will continue between the partners.
- Further proposals for visits, study exchanges and guest lectures between partners will be made.





ASSOCIATE PARTNERS

ESTONIA



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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