

NEW DRAFTS FOR THE INTEGRATION OF MODERN TECHNOLOGIES AND METHODS IN EDUCATION AND TRAINING

ANICA MEINS-BECKER, AGNES KELM, LARS LAUBAT, and MANFRED HELMUS

Construction Management & Economics, Bergische University, Wuppertal, Germany

Today, modern technologies and methods of the improvement of the digitization in Germany – e.g., the application of the Radio Frequency identification (RFID) technology also in connection with the method of the Building Information Modeling (BIM) – find increased implementation in construction economy and real estate economy in Germany. For many years, the research team of the Chair of Construction Management & Economics of the Bergische University of Wuppertal has dealt with the development of those modern technologies and methods. Now these subjects are transferred into new education and training programs. These programs are based and further developed on the present knowledge. For the education of students in Germany, different study drafts will be developed in cooperation with the Jade University of Oldenburg. Construction engineers and architects will be taught a process-oriented method with the use of BIM, integrating the application of modern technologies comprehensively along the life cycle of buildings. Furthermore, within the research project “BIM-based construction with RFID technology”, there was developed an integrated teaching demonstration module which shows the data exchange and data consistency in the life cycle of buildings very clearly. For a period of 2 years, this specific demonstration module will be presented to the public and different institutions, like educational centers, universities, building contractors and developer of the industry. An international comparison of these attempts offers interesting aspects concerning any transference potential. The conference contribution will contain the first results of new drafts for integration of modern technologies and methods in the education and training for the construction and real estate economy in Germany.

Keywords: Digitization, BIM, Process-orientated method, Life cycle.

1 INTRODUCTION

The process of digitizing the value added chain arrives slowly in the construction and real estate industries in Germany. Topics like the intra-company (closed-BIM) or company connecting (open BIM) usage of BIM belong to the most important trends in the evolution of construction and real estate industries. In correlation with the usage of auto-ID-technology for digital marks of objects it will be possible to record process data during the whole life-cycle of real estate, to control with a target-actual comparison, and it will be possible to regulate and document the data. The result will be safe and optimized processes with an optimal documentation.

With this input the chair for construction economics and management of the “Bergische Universität Wuppertal” – the University of Wuppertal – starts. Next to the execution of countless research projects dealing with the usage of modern technology during the whole life cycle of real estate since 2005 and assisting in certain committees, which work on a standardization of a larger usage of modern

technologies, the chair for construction economics and management develops different concepts for integrating modern technologies in (further) education.

The goal will be to sensitize for and to teach trainees, students of civil engineering or architecture and all professional groups dealing with constructing and real estate the current trends in the usage of modern technologies.

2 CURRENT STATUS OF RESEARCH AND PREVIOUS EXPERIENCE

The usage of the BIM method increases internationally. There exist a lot of publications and first concepts for (further) education focusing the BIM-method. The chair for construction economics and management did a wide inquiry and evaluation dealing with this topic focusing the United States and the European countries Germany, Switzerland, Great Britain, Netherlands, Finland and Denmark.

The evaluation was built out of literature (and internet-) inquiry and also out of certain interviews hold with specialists. The publication of the results is planned for June 2015. The results show first approaches in integrating BIM in (further) education internationally. The existing concepts of (further) education usually focus on studying the usage of software. In the area of teaching the comprehension and usage of the BIM-method will be integrated in the existing courses.

Outside the University of Wuppertal there are yet no concepts for (further) education of Auto-ID technology (Barcode and RFID) for civil engineers and architects existing.

Concepts of teaching the BIM-method linked with Auto-ID technology along the chain of process during the life cycle of real estate do not exist yet.

Currently open questions about BIM, RFID and standardization, drawn on already finished and running research projects, especially within the research project “BIM-basiertes Bauen mit RFID-Technik” – BIM-based constructing with RFID technology – are answered. To this belong questions about the level of marking (i.e., products, shipping unit, containers, components, machines, persons, shipping documents), about the used structure of numbers, about the use of classifying systems and exchange of data. For a first approach in establishing the knowledge about (further) education a demonstration module was developed. The module demonstrates the BIM-method and the usage of Auto-ID-technology during the life cycle of real estate.

The demonstration module is presented for 2 years in universities, training centers, fairs, construction companies, investors, facility managers, developers, deconstruction companies and for the public community all over Germany.

Also the usage of the BIM-method and AUTO-ID technology for documenting data is integrated in certain courses of two extra-occupational-master-degree programs. These master programs lead to the degrees “Master of Real Estate Management and Construction Project Management” and “Master of Business Engineering construction operation/management/processes/technology”.

3 FURTHER METHODS

Based on previous results, there are currently followed initiatives executed to define and standardize a wide concept of (further) education, which is developed with partners from the industry. The concepts will be provided for other institutions, contingently also international.

3.1 Working Package

3.1.1 Working package 1: Definition of the content separated for the concept of (further) education based on basic knowledge from certain research projects about BIM

Through different research projects basic knowledge about concepts of (further) education should be provided. The focal point is the central research project “Entwicklung einer idealtypischen Prozesskette zur Anwendung der BIM-Methode im Lebenszyklus von Bauwerken” – development of an ideal chain of process for using the BIM-method during the life cycle of real estate. The goal is the development and definition of a standardized idealistic virtual chain of process during the life cycle of real estate using the BIM-method. Different standardized scenarios are developed equivalent to the process, also the level of information detail and content of information are defined by companies from the industry and BIM-specialists. Results from parallel projects, which work on details of the process chain, should be integrated, i.e., “Entwicklung eines Anforderungskatalogs an Gebäudedatenmodelle in Bezug auf die Standardisierung der Detailinhalte und Detailtiefe aus Sicht des Arbeitsschutz” and “Entwicklung eines Anforderungskatalogs an Gebäudedatenmodelle in Bezug auf die Standardisierung der Detailinhalte und der Bauausführung” – “Development of requirement specifications on real estate data models referring to standardizing detail content and level details from the view of work safety” and “Development of requirement specifications on real estate data models referring to standardizing detail content and level of details out from view of construction execution”

The contents of teaching will be – based on the results of the central research project the content of teaching i.e., use of process relevant software, guidelines, perfect timing, type and range of data – developed easily.

3.1.2 Working package 2: Development of the (further) education curriculum

The curriculum will be developed on the base of results of working package 1. Also possible possibilities of certification will be analyzed and defined.

3.1.3 Working package 3: Verification and validation of the results through cooperation with multiple research institutions and the industry

A Cooperation between the chair for construction management and economic of the university of Wuppertal and the BIM-institute of the Jade-Academy Oldenburg was founded to develop a (further) education concept for Germany, which can be used for universities and academies. Further cooperation is planned. Due to a large network all results can be verified and valued with cooperation partners from the industry.

The exchange of information about (further) education concepts is also planned on an international European level.

3.1.4 Working package 4: Installation of a BIM-labor at the University of Wuppertal

Currently a 100 m² BIM-labor with many kinds of technology is installed at the University of Wuppertal. It will be used for the education of civil engineers and architects at the University of Wuppertal and for the further education of different types of professionals of the construction industry. Since the resulting offer of

further education applies to all of Germany, the BIM-Labor in Wuppertal also works as a demonstration labor.

4 CONCLUSIONS

The demonstration module of the research project “BIM-basiertes Bauen mit RFID-Technik” – BIM-based constructing with RFID-technology – received a good review and will be presented for the next couple of months in Germany to the publicity.

Intermediary results from the further education show, that the development of a separate course, worth 6 credit points, for students of civil engineering and architecture at the University of Wuppertal is goal orientated. In this course the BIM-method will be explained by different BIM-specialists to groups of about 12 students. The knowledge will be shown on the basis of a simple project between civil engineers and architects. Besides the professional competence, teamwork will be strengthened and imparted.

Intermediary results of the further education show that currently a lot of further educations to a “BIM-Manager” are offered, especially by software companies. The procedure of developing the offer of further education of the chair for construction economics and management of the University of Wuppertal claims to do basic research on the development of an ideal BIM-actual-process chain and establish the new results in specific further education courses.

In the opinion of scientists the introduction and teaching of BIM-method and Auto-ID should be held double-tracked. On one hand the usage of modern technology should be started early through lectures and (further) education concepts within the scope of working isolated applications (little open BIM or closed BIM and single applications for using AUTO-ID technology). On the other hand, a fundamental development of standards for an integrated usage of modern technologies during the life cycle of real estate is missing, which means that the research has to be advanced, especially the development of an ideal BIM-target-process chain, since BIM is still in a beginning stage in Germany. (Further) Education can be developed easily then.

References

- Bredehorn, J., Kelm, A., Kortmann, J., Laußat, L. Meins-Becker, A., Wagner, S., and Zwinger, U., BIM-basiertes Bauen mit RFID, Tagungsband zum Forum Bauinformatik 2013.
- Helmus, M., Kelm, A., Laußat, L., and Meins-Becker, A., RFID in der Baulogistik - Forschungsbericht zum Projekt „Integriertes Wertschöpfungsmodell mit RFID in der Bau- und Immobilienwirtschaft“, Vieweg+Teubner Verlag, 2008.
- Helmus, M., Kelm, A., Laußat, L., and Meins-Becker, A., RFID in der Baulogistik - Forschungsbericht zum Projekt „RFID-unterstütztes Steuerungs- und Dokumentationssystem für die erweiterte Baulogistik am Beispiel Baulogistikleitstand für die Baustelle“, Vieweg + Teubner Verlag, 2011.
- Helmus, M., Kelm A., Laußat, L., and Meins-Becker, A., Processes of ID-based linking of structural relevant construction phase data to planning phase data using auto-ID techniques; Tagungsband zur 5. SEMC-Konferenz; S. 1807 ff.
- Helmus, M., Laußat, L., Kelm, A., and Meins-Becker, A., Processes of ID-based linking of structural relevant construction phase data to planning phase data using auto-ID techniques; Tagungsband zur 5. SEMC-Konferenz.

- Helmus, M., Laußat, L., and Meins-Becker, A., Logistik und Qualitätskontrolle per Datenchip – RFID in der Bauwirtschaft – Teil 1 und Teil 2, Baumarkt + Bauwirtschaft, 4/2008 and 5/2008.
- Helmus, M., Bredehorn, J., Kelm, A., Laußat, L., and Meins-Becker, A., RFID und BIM - Konsistente Datenerkennung in modellbasierten Planungs-, Arbeitsvorbereitungs- und Logistikprozessen; Bauingenieur 2013/2014 (VDI-Bautechnik), S. 91 ff.
- Meins-Becker, A., Modell Baulog, Dissertation, Sharper Verlag, 2013.