EXPLORING BIM INTELLIGENCE FURTHER WITH ITWO

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ABSTRACT

In the past decade, the AEC industry in Denmark has been increasingly exploring BIM intelligence, predominantly in the public sector and educational institutions. Since 2006, the School of Architectural Technology and Construction Management has been teaching a number of BIM technologies considered relevant both for the field of study and for the industry. In 2017, the school searched for smarter solutions within digital data exchange, with the scope of optimising the students' workflow in BIM, and for providing the industry with constructing architects skilled at the smartest digital technologies in the market. The same year, the department management initiated a collaboration with RIB, a software developer and vendor for smart digital solutions for the industry. The interest was the iTWO baseline digital platform, a technology that enables interactive 3D, 5D and 4D BIM in one single software. iTWO became implemented first in the 4th semester of the Construction Management course in spring 2018. The project was a success for all involved. This led to the inclusion of iTWO teaching in the 3rd and 5th semester CM programmes later on. Based on positive evaluations, one year later, the school entered a new contract with RIB on iTWO 4.0, a cloud based 5D platform, displaying a richer functionality for digital data exchange in projects. The paper presents the 4D and 5D work at the school before and after the iTWO implementation, including an outline of industry view about the software.
Keywords: BIM, iTWO, integrated 3D, 4D and 5D data, construction management, virtual simulation.

1 INTRODUCTION

The paper intends to present the scope, process and outcomes of implementing iTWO in education, at the Copenhagen School of Design and Technology and outlines the view of selected major contractors in Denmark about digitalisation of projects in general, and the iTWO technology in particular. The method used will mostly be descriptive and explanatory of selected BIM technologies for construction planning and their application in teaching, with reference to EU and national requirements for digital projects, selected research within BIM and a short interview with core players from the construction management sector.

The construction sector provided 18 million jobs and contributed almost 9% of GDP in Europe last year [1]. In fact, over the past two decades, labour productivity has grown at around only a quarter the rate in manufacturing (1.0% vs. 3.6% respectively) making the construction sector the poorest performer in terms of productivity [2]. Its profit margin is one of the lowest of any industry, while also being one of the most cyclical. This means that any firm that invests in capital, which raises its fixed costs, is vulnerable. By contrast, companies that employ lots of workers without investing much can simply cut their workforces if necessary [3]. "In Europe there are 3.3 m with an average of just four workers. Competition is fierce and profit margins are thinner than for any industry except retail. This fragmentation creates its own problems. Slim margins make investment even less likely. Often projects have more than a dozen subcontractors, each keen to maximise profit rather than collaborate to contain costs", says Thijs Asselbergs, professor at Delft University of Technology [4].

Luc Luyten of Bain & Co, claims that companies have failed to consolidate due in no uncertain terms to fragmentation, identifying differing building codes in different regions, which only discourages benefits of scale. Also, in China, low labour productivity, has forced procurement into some automotive methods, through 3D printing and modular construction [4]. Both these conditions, lead towards a problem statement: is there a programme to

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consolidate differing productivities and data schemes without the need to start from scratch each and every time? This brings the notion of harnessing meta-data and databases into the equation.

2 APPLICATION OF 4D AND 5D BIM IN THE INDUSTRY AND EDUCATION

Digital construction in Denmark has been evolving since 2007, endorsed by governmental law for BIM requirements in the public construction sector. A decade later, 78% of Danish AE companies used BIM for clash detection, 3D visualisation and BIM performance. The Danish construction industry had a considerable impact on this process, along with the main driver of this development, the public procurement regulation. Currently, over 65% of BIM user companies anticipate using BIM in all their projects in just a couple of years [1]. MT Højgaard, one of the largest construction companies in Denmark, has recently conducted an analysis on BIM maturity in the Danish building sector. The results indicate that effective collaboration of the project team in BIM projects is very important for achieving the client's digital requirements. This however sets a requirement on the client itself, for instance regarding the ICT strategy settlement and its incorporation in the tender material in BIM projects. The analysis also shows that projects covered by the current ICT regulations, the order 118 and 119, are providing significantly higher project value then projects under the earlier ICT frames [5].

2.1 The AEC sector and 5D BIM in Denmark

There is a general awareness in the AEC sector about the potentials of digital projects and supporting technologies. The ICT regulation in public procurements continuously aligns with new BIM developments, and lately, in 2018, this was also followed by revisions of the local AEC Contracts Conditions and AE Plans of Work. The EU construction strategy indorses digitalisation of projects in the public sector, and the core argument is plain and simple – transparency and efficiency of contracts and deliverables.

During the past decade, the application of 4D and 5D BIM during design, tender and construction management has become a known work technology in larger AEC companies in Denmark, positively affecting their business and the project supply altogether. The techniques are however still fragmentary, relying on much software to perform data integration. Revit performs 3D modelling, then Sigma Estimates or other pricing databases linked to Revit will perform the pricing of extracted QTO, which then transfers relevant data further to a scheduling technology. Although there is a gain in using this method, in terms of time saving and even accuracy, the technique is incomplete, as it is one directional. Any updates in the schedule will not loop back to the model and the initial QTO.

BIM technologies developed for supporting digital construction, are however not taking hold in medium and small enterprises, a business segment, which although is very important for the construction industry, still utilises traditional planning and management techniques, regardless of whether this work method does not lead to genuine profit or improvement of general productivity. Due to this fact, such companies are also struggling with tenders in public projects, which require digital tendering. Public clients require digital platforms for both communication and tendering, not least the use of a variety of standards for BIM work. Lack of knowledge and experience with digital project protocols will very unlikely provide such companies with a contract.

Software developers and vendors are just as important players in this process, contributing with smart technological solutions for digitalisation. One particular interest of this business is oriented towards developing BIM technologies for the construction management sector.

New virtual technologies facilitate model-based tendering, construction scheduling and costs tracking allowing for great data transparency and simulation possibilities. One such technology is the iTWO platform, presented later in Section 2.3. This is a remarkable progress compared to traditional bidding and scheduling techniques. However, this also means that contractors not matured enough for BIM projects need to catch up and invest in digital means.

2.2 4D and 5D BIM in education – a fragmentary approach

During the past decade, affiliated educational sectors in Denmark have been using various BIM technologies in teaching. Aside 3D BIM and related applications for consistence and collision control, 4D and 5D modelling techniques have been having an increased use. The Technical University of Denmark and Building Informatics section in Aalborg University were the frontrunner universities in the field. Meanwhile, by 2010, the ATCM School delivered a PhD study about BIM implementation in education [6], which triggered a higher emphasis on BIM teaching at the school in most technical disciplines. Ever since, this development evolved, following new trends in BIM both locally and internationally. Compared to the industry work methods and development implementations, educational practice involves a great deal of pedagogical concerns, first and foremost in general sense, as required by the code of pedagogical practice for the level of education, and especially when developments of technological kind need to be implemented in the teaching curricula.

The prime teaching and learning methods at the school have always been project based and functional, using the principles of problem-based learning as the driving work method. Project based work at the ATCM school means organised groups of students working on real life projects, supported by interdisciplinary teaching, evaluations and consultancies at the desk. Teacher teams hand out a 2D Concept design to students, typically a failed competition proposal, which the students will gradually develop into a fully designed project, in both 3D BIM, 2D drawings, 4D BIM, 5D BIM and other relevant planning and law documentation. Functional learning means application of a high extent of AEC industry practice in the project development, such as design and construction standards, procedures and building law regulation. Teaching is rather technical, that is, highly instructional, but largely also collaborative. There is lesser theory in teaching, and more guidance in problems settlements and solving, research for solutions, alignment to regulation and in understanding the complex interrelation of project information. Project based education at the school provides generalist graduates for the building industry, with a solid set of technical and digital skills, highly applicable in any AEC company from day one.

Fig. 1 below shows the study structure at the School, mainly divided in a core programme (CP) in 1–5 semesters and elective courses (EC) in 3–5 semesters. This is followed by an internship semester and the 7th semester for finals. The electives offered are Construction Management (CM), Design Consultancy, (DC) and Facility Management (FM). All students follow core programmes, then they split and follow elective courses. The latter, is a pick and choose model, that is, students can change electives from semester to semester, thus having the opportunity to explore other fields and knowledge.

Teaching in object-oriented design at the school started in the summer of 2006, where a group of staff investigated the next platform for the school's digital development, with regard to a software upgrade or a new paradigm shift. All available software was acquired and tested robustly to assess the best contender. These included (at the time), Architectural desktop, (plain) Autocad, Revit, Microstation, Archicad, Vectorworks and some other lesser known products, in an attempt to appraise their merit and contribution to the education, the industry and society in general. After much deliberation Revit was chosen, not lest but because they

promised IFC compatibility, thus ensuring that we were not ring-fenced to a product and its effects. At the time the industry was geared towards Autocad software and jumping ship was near to impossible. It was decided to run a pilot test in the start of the second semester for introducing Autocad, a three weeks intensive CAD course. Currently, the core study programs are incorporating 3D BIM, mainly Revit Architecture and Revit Structure, and to a certain extent 4D and 5D BIM. The following illustrations (Figs 2–8) will summarise the 4D and 5D BIM, using the Revit model shown below.

As shown in Fig. 3 left corner, Revit displays a Sigma Estimate plugin, a link that allows connection of Revit quantities with Sigma. The level of cost estimate always aligns with the Level of Development (LOD) in the model. If the model is at LOD 100, the cost estimate will be gross floor area based. Later, at LOD 300, Revit links element quantities from the model with element cost in Sigma, providing an Elemental Cost Plan for design information and regulatory check purposes.

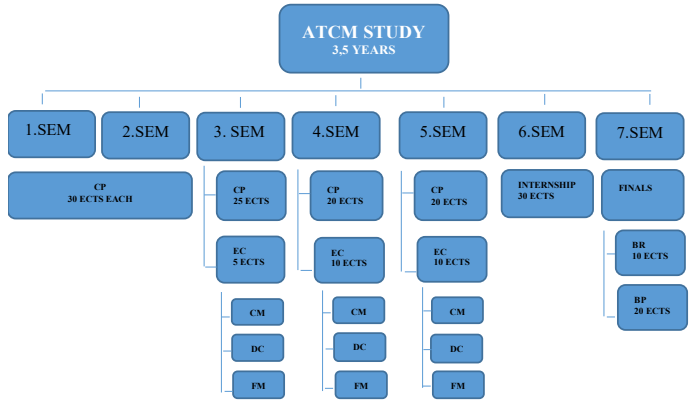


Figure 1: 3D Revit model.

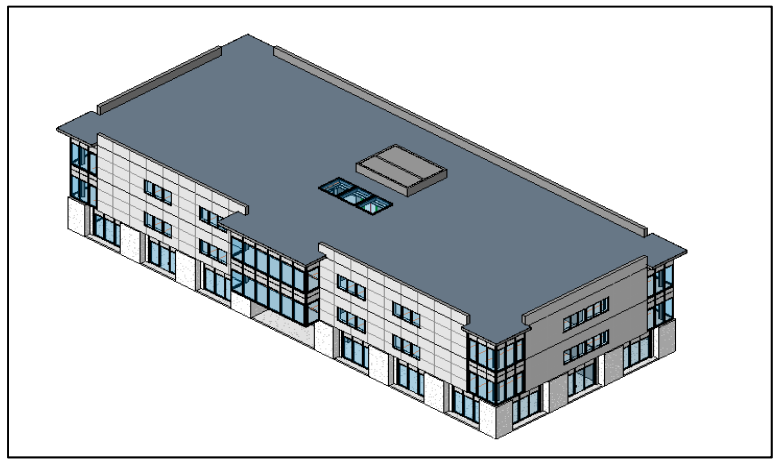


Figure 2: ATCM study structure.

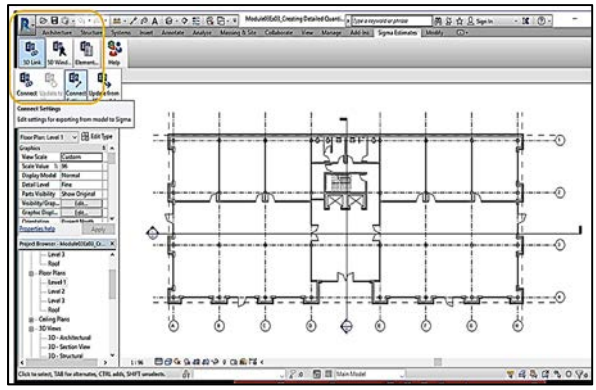


Figure 3: Sigma Estimates 5D plug in Revit.

Fig. 4 shows wall elements selection in the model for QTO, followed by a 5D type coding, performed in Revit, which links the elements to a price library, shown in Fig. 5. The price library contains a large number of building elements labelled with local classification codes.

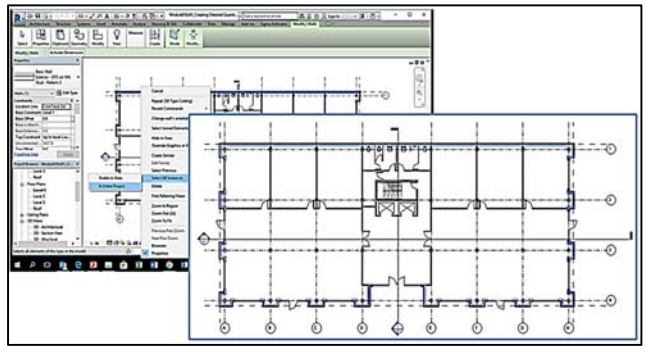


Figure 4: Ext Walls QTO.

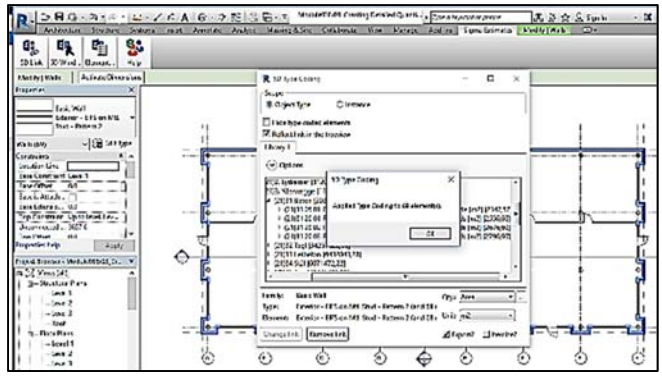


Figure 5: QTO linked with price data.

After performing this step with all elements considered for Revit QTO, the Sigma – Revit integration link will compute the quantity data from Revit to Sigma, as shown in Figs 6 and 7. Given that, 3D models developed at the school are mainly architectural and structural, students will perform the QTO for mechanical, electrical and plumbing works by manual measurement, then include these quantities in Sigma for costing.

The cost library in Sigma (Fig. 7) also contains data for construction time per Unit of Measurement (UoM) in hours, for each element, and construction time total in hours for the whole QTO of each element type. Time data represents construction duration used by one construction worker for a task. For scheduling purposes, the total hours for each element is exported from Sigma to MS Project. During the computing process of time data between the two software, the latter will divide total hours to standard working hours per day, in Denmark 7.4 hours, and create the exact breakdown structure of works in MS Project as prepared in Sigma, displaying Gant bars with a duration total of one-man days for each activity. These steps are not illustrated in the paper due to paper size limitation. The remaining tasks for scheduling is manual. Each activity will be analysed with regard to the crew sizes necessary to perform the job, contingencies and curing time for concreting works. After this, activities relationships are determined, and the MS project layout finalised as displayed in Fig. 8.

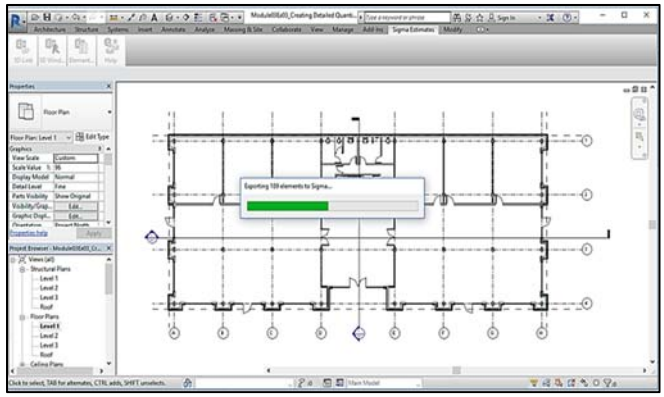


Figure 6: Revit QTO export to Sigma.

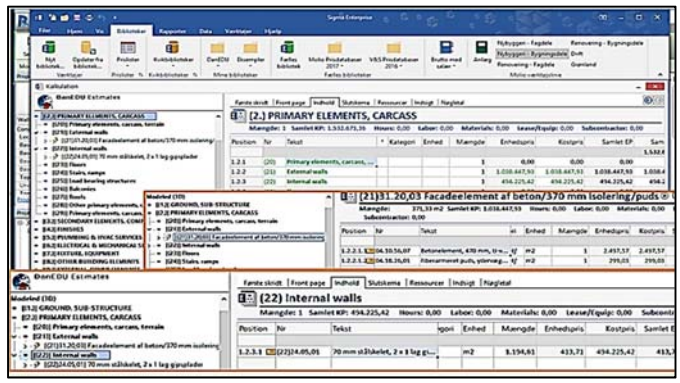


Figure 7: QTO in Sigma linked to costs.

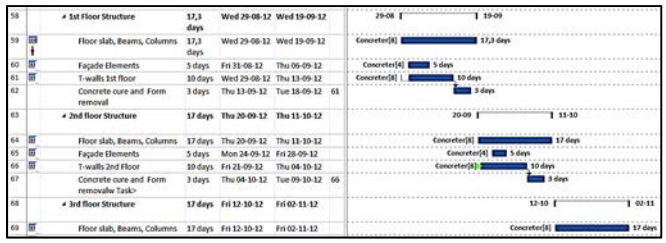


Figure 8: Duration data exported from Sigma to MSP, Crews and relations determined.

Revit QTO connected to price libraries, such Sigma Estimates as described above, is a model-based cost estimating method, allowing for quantities measurement accuracy and for higher work speed. Although both the industry and education applies the method, the final estimate will still contain plenty of manually measured quantities and estimates, due to a number of facts. BIM project limitation to only certain design disciplines is one frequent factor even in public sector tenders. The same aspect is present in education. There is no time in the study schedule to develop all design disciplines into 3D models, which leads to a partial 5D and 4D computing. Aside this, the fragmentary feature of the method does not allow for automated re-looping of data exchange between design, quantities and cost, if problems are detected in the chain, or design is iterated. One will need to go back to the 3D model, and perform the process again. As mentioned earlier, this makes the method rather rigid as it is one directional. However, it does allow for quantities accuracy in BIM based projects, whether used in design stages estimates, tenders or pre-construction planning. A trained estimator in the method described above would be beneficial for both the client, his team and contractors. Most of our students can supply this service, despite their lack of field experience.

2.3 iTWO for 4D and 5D BIM – Concept and implementation at the ATCM School

The ATCM School has always been technology oriented, providing graduates for the industry with excellent BIM skills. In 2017, the school management looked for new BIM developments available on the market, useful for both 3D BIM, 5D and 4D BIM. The scope was twofold. First, integration of smarter BIM solutions in education would deliver cutting-edge skills for the industry; second, attract students to the education. In summer 2017, the school signed a contract with RIB A/S, on implementing a recently developed software for 5D and 4D BIM in education, the iTWO baseline. RIB A/S is a Danish software developer and vendor branch of the German RIB software company, which provides the building industry with smart technologies for Project Management, 5D BIM and Facility Management. RIB in German means revolutionising construction – Revolution Im Bauwesen.

The iTWO concept, shown in Fig. 9, displays an intelligent technological platform, which allows for virtual 5D and 4D simulations of models data used by for contractors. This "Virtual Process" is very useful for monitoring and recording real data in the construction process, called here "Physical Process". In iTWO, the generic flow of performing estimates through design, tender or construction is similar to the traditional planning sequences. The generic flow of performing estimates through design, tender and construction is however the same as in traditional planning sequences, where CAD or BIM material needs to be in place and scrutinised by contractors in order to extract quantities, perform bid estimates, collect bid

quotations, perform subcontracting, etc. What differs is the technology, which allows for automated re-looping of data exchange between various project stages, using a single software platform. For instance, alterations of any kind in the 3D Model will automatically change initially processed information in iTWO.

The core iTWO subjects selected for education were CAD/BIM, QTO, Estimating, Tender and Subcontracting, highlighted in Fig. 9.

2.4 iTWO Baseline practiced in the ATCM education

The iTWO project contract included a RIB course for teaching staff, on spot support from RIB during training sessions at the school's VDC and eight licences, setup for use in the lab. In September 2017, relevant teaching staff enrolled in a 5 days iTWO course, delivered by RIB in the VDC lab. The teacher team in collaboration with RIB, has carefully tailored the course content to the needs of 5D and 4D BIM teaching. Fig. 10 shows the actual sessions and subjects planned for the course.

Incorporation of iTWO teaching in the study plan started in spring, 2018 in the 4th semester Construction Management elective. After lecturing sessions in the VDC lab, students worked with iTWO both within the formally scheduled sessions and outside the study work plan. They used the 3D project models developed by themselves in the Core Program of the 4th semester. After importing the model from Revit into iTWO, students have reproduced a real-life scenario of a digital tender situation. The BIM Qualifier function seemed to interest them a lot, as it cheeked the quality of their 3D model. Moreover, the check of the "Client BoQ with QTO" released in the "tender material" against the Actual QTO (AQ) measured by them in iTWO as "contractors" (Fig. 11), provided valuable group reflections. For this exercise, students used the BoQ with quantities created by themselves in

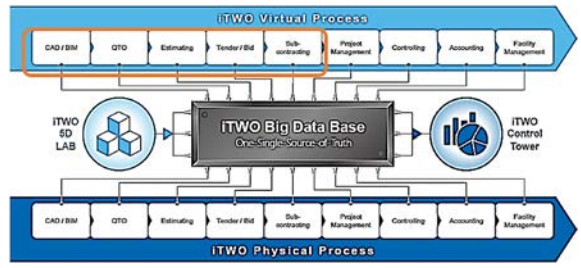


Figure 9: iTWO baseline – Core structure. *(Source: Courtesy of RIB A/S.)*

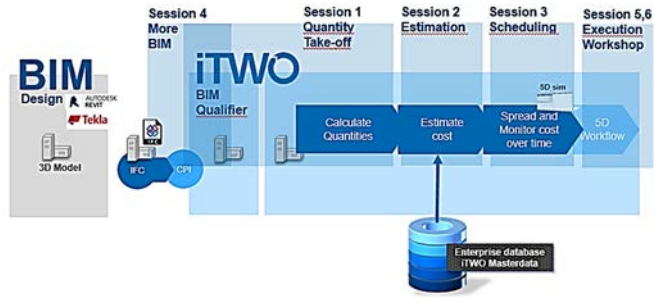
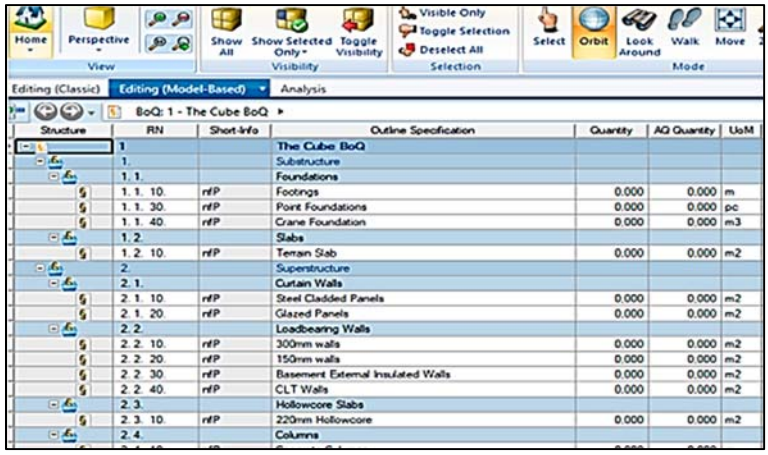


Figure 10: iTWO Baseline course content for teaching. *(Source: Courtesy of RIB A/S.)*



Structure	RN	Short Info	Outline Specification	Quantity	AQ Quantity	UoM
	1		The Cube BoQ			
	1.		Substructure			
	1. 1.		Foundations			
	1. 1. 10.	ntP	Footings	0.000	0.000	m
	1. 1. 30.	ntP	Point Foundations	0.000	0.000	pc
	1. 1. 40.	ntP	Crane Foundation	0.000	0.000	m3
	1. 2.		Slabs			
	1. 2. 10.	ntP	Terrain Slab	0.000	0.000	m2
	2.		Superstructure			
	2. 1.		Curtain Walls			
	2. 1. 10.	ntP	Steel Cladded Panels	0.000	0.000	m2
	2. 1. 20.	ntP	Glazed Panels	0.000	0.000	m2
	2. 2.		Loadbearing Walls			
	2. 2. 10.	ntP	300mm walls	0.000	0.000	m2
	2. 2. 20.	ntP	150mm walls	0.000	0.000	m2
	2. 2. 30.	ntP	Basement External Insulated Walls	0.000	0.000	m2
	2. 2. 40.	ntP	CLT Walls	0.000	0.000	m2
	2. 3.		Hollowcore Slabs			
	2. 3. 10.	ntP	220mm Hollowcore	0.000	0.000	m2
	2. 4.		Columns			

Figure 11: Client QTO and Actual QTO.

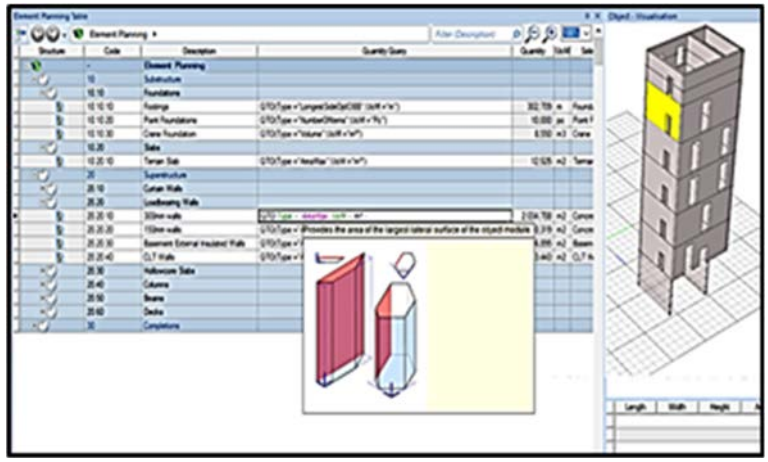


Figure 12: QTO prepared by the contractor.

the core semester model where they performed as designers. In iTWO, students developed actual QTO based on the quantity queries function using measurement scripts for each element type in the 3D model. Fig. 12 shows only one of the staircases in the building, with calculation of its external wall quantities.

Based on the actual quantities measured in the model, students then performed the cost estimate for elements, using cost codes for each resource type and finally adding cost allowances for general office administration and profit. Fig. 13 shows the estimated unit costs for elements and the cost total of the material, labour and plant resources.

The last iTWO task performed be students was scheduling and simulations. Fig. 14 exhibits a simulation of the construction process and cash flow development through the construction stage, with activities durations generated from the cost estimates. The cash flow

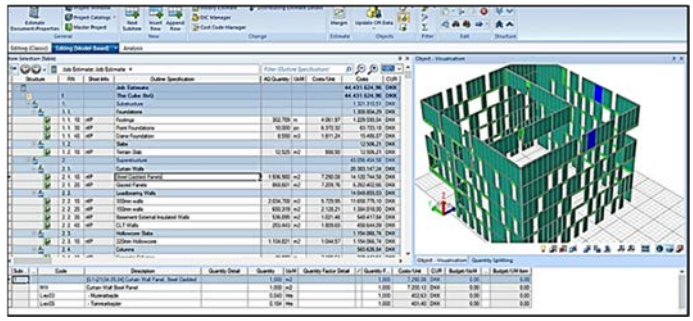


Figure 13: Elements cost estimate.

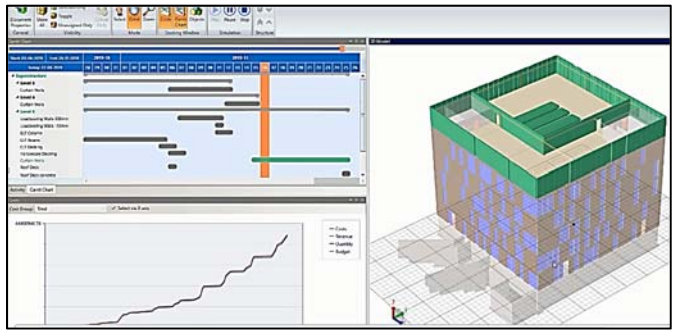


Figure 14: Activity Model and 5D Model simulation.

development diagram shows the progress of construction costs, revenue, quantity, and construction budget total. These simulations are core elements in iTWO, where any alteration of design or construction sequence automatically changes the course of the cost.

In the end of the course, the teacher team examined students individually in both theirs skills for operating iTWO and in their understanding of the scope and benefits of the technology. RIB assisted the exam, and gave valuable feedbacks to the students. The close collaboration between RIB, the teachers team and the students, provided a natural and constructive work environment, where students were welcome to contribute with improvement ideas. A large extent of the lab work was carried out in a learning by doing mode, both by teachers and students. Although RIB has provided great teaching material, as in many cases of technology teaching, there were a number of aspects, which the users themselves had to sort out. While the iTWO implementation in the 4CM elective course required additional teaching and learning time – first to learn the technology, then perform quality towards the exam, both the teacher team and the students managed the process quite successfully. Evaluations from the students were rather positive, acknowledging the valuable potentials of the software in education and for the industry, regarding the information interrelations and transparency in the 3D, 4D and 5D models. In fall 2018, teaching in iTWO was incorporated in the 5th semester Construction Management teaching plan as well, and in spring 2019 RIB has extended the licences to 20 seats, which allowed for all CM courses to use the programme.

2.5 iTWO 4.0 in the ATCM education

Based on the successful implementation of iTWO baseline in all CM electives, and the positive assessments of outcomes by RIB, the teaching staff and the students, the school management entered a new contract with RIB on implementing the iTWO 4.0 version in teaching, this time including the technology also in the core programme of the 3rd semester. iTWO 4.0 is a cloud computing solution, which allows for larger classes to use the programme. Compared to iTWO baseline, the iTWO 4.0 platform displays a more intelligent structure and smoother operation of its functions. It contains an extended and customisable desktop for a variety of business purposes in the supply chain of a construction project. Due to size limitation of the paper, it is not possible to give a more informative outline of iTWO 4.0, or of the course content for education. The implementation process of the new platform in teaching and its outcomes will be the subject of a next paper for a BIM forum.

2.6 Industry view on iTWO

For a more holistic view of the iTWO potentials for the industry, we conducted a short interview with Ole Berard (OB), head of digitalization at Züblin A/S in Denmark and Esben R. Jessen (EJ), senior project manager at the VDC department at MT Højgaard. Both companies are using iTWO baseline in several of their projects. Züblin has been using iTWO in Denmark for five years, initially also being part of developing the early version of iTWO, by German employees in the company. The good collaboration between German and Danish estimators in the company has led to a suitable knowhow in using the software. Currently Züblin is using iTWO in design stages, tenders and construction stage. OB pointed out several challenges with new technology implementation in a company. "(…It makes it) difficult to implement the software if you do not have a certain size. You need a lot of support to operate the software (which) makes it difficult to implement…" [7].

Resource development capacity and finding training time for the estimator staff is also a problem. Nonetheless, OB emphasises the relevance of skilled estimators for the industry in a growing digitalisation of the building sector. He sees the estimator job as a necessary profession, stating that educational institutions need to be aware of this fact. "There are few people developing these skills coming out from schools. There is a lot of reward working as a tender estimator professional nowadays" [7]. OB assesses iTWO as a powerful tool, if deployed adequately. It offers a high degree of transparency, when integrating design and cost. Moreover, it is a good communication means between the project team and the client, he states. "Extra works discussions are easier to get with iTWO, compared to the model-based way of working that we had previously. It is easier to explain to a client what will be wrong or what was wrong during the construction stage. Eventually, integration of design, cost schedule and simulations give a better overview of the changes and the problems during the construction stage in a project" [7].

MT Højgaard (MTH) uses iTWO in several digital projects with success. In line with OB, EJ also points at the revolutionising feature of integrating 3D, 4D and 5D data under one platform in iTWO, which he sees as very beneficial for construction planning. Compared to different individual softwares that the company normally used, such as Vico, Solibri, Bluebeam, EJ sees iTWO as the best software so far, solving a great deal of information exchange problems in a project. The simulation of 4D and 5D alternatives is particularly relevant for contractors, he states: "…simulations for different alternatives by using iTWO can be an advantage when competing for a project. It is easier to improve unforeseen events for the different alternatives and show the client the consequences" [8]. Projects where MTH

has used iTWO performed with lesser surprises and problems which were easier to detect early on – before construction. EJ also points out some challenges the company has been facing with the technology. Time for upskilling staff with new technologies is a problem in the contractor sector, not least the collaboration between managers if some possess new technological skills. "…a problem is that there are no project managers on site that have that time for training. They have to balance the people who has software knowledge with the people that has construction knowledge, gathering these people and making them work together" [8]. He adds "…playing around with computers, is not on the agenda of most of the project managers during the execution stage" [8].

Use of smart technology in a project, such as iTWO, EJ says, only bears fruit if the whole project team is skilled for digital collaboration. Another problem he relates with subcontractors, as there is a large spectrum of digital maturity levels in the subcontracting sector. To handle that diversity in a project is not an easy task, EJ asserts. For this reason, MTH does not use iTWO with subcontracting.

MTH and Züblin do not intend to use iTWO 4.0 yet. For the time being iTWO baseline satisfies the companies' needs. Basically, iTWO is used when working on digital projects. Although both companies are seeing great potential in iTWO, MTH points at that competing software on the market, can do parts of the job even though the workflow is fragmentary, which makes the increase of iTWO use in Denmark difficult. Currently, it is only MTH and Züblin who are using iTWO for 4D and 5D BIM in Denmark.

3 CONCLUSION

During the past decade, the increase in technological development for the building industry has been reshaping the AEC sector and the affiliated educational institutions. Innovative technologies introduced to the sector drive the sector forward, aiming at productivity and efficiency improvement throughout the project lifecycle. BIM applications are continuously emerging showing great potentials to automatize construction projects data. Digital construction strategies from the Danish government are demanding digital technologies and collaboration in public projects. Digitalisation demands require alignment of local regulation regarding contract conditions and plans of work for AEC actors. Above all, digital technologies and collaboration demands change of the old ways of working, which does not seem to be easy for all sectors in the industry. Change is clearly time consuming, and construction companies do not seem to be keen in investing in development, despite that productivity in the construction sector was flat for decades. Only large companies show interest in changing work technologies, and see the benefits of the change. Although the digital maturity level in the Danish AEC sector is rather high, large construction companies are still struggling with subcontractors' lack of interest in upgrading old work techniques.

Educational intuitions have been aligning in the past decade with digital demands, investing in smart technologies, upskilling teaching staff and revising requirements for learning outcomes and teaching plans. The ATCM School is definitely following this development. The implementation of iTWO in the Construction Management course was both strategic and necessary. Students have learned about data exchange in a project in a different way, getting a more detailed understanding how design, cost and time data affect each other, both during design, tender and construction. Not least, alteration of this relationship showed them that optimisation might not even be so difficult. They have also learned that project data presented in virtual work environment to clients, can facilitate communication and the clients' understanding of alternative solutions and their outcomes.

Moreover, the scope and potentials of harnessing meta-data and databases for future projects by using a single digital platform became quickly evident for both teachers and

students. It is now clear that iTWO will equip CM graduates, and latter all graduates from the school with a set of skills for highly automatized information technologies, which surely will have an influence on the industry. Virtual work environments seem to be the future in the building industry, and the school of ATCM will follow this trend. The newest technology for 4D and 5D BIM – the iTWO 4.0, in a few weeks' time is ready for class teaching.

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