THE ADAPTION OF BIM IN THE ALBANIAN CONSTRUCTION INDUSTRY

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ABSTRACT

As a process in evolution, AEC has started its project drafts with the use of two-dimensional (2D) drawings, later evolving with the three-dimensional (3D) drawings and space projection, with the very helpful tool, of Computer-Aided Design (CAD) (Kong et. al 2020). The purpose of this paper is to examine the adaption of Building Information Modeling in the Albanian construction industry. Albania has been introduced to BIM in these recent years and has started its application in architecture and construction in several major projects. Yet, the aim of this study is to examine the incisive effect that BIM has in the Architecture, Engineering and Construction (AEC) industry, coming up with specific conclusions about its influence and effectiveness throughout the whole process of the project. Such qualitative observation will be taken from interviews with architectural, construction companies and BIM professionals. Also, the goal is to conduct a set of questionnaires providing deeper and factual responses. It is to be found whether the application of BIM has been beneficial, which are its risks and how can they be improved taking into consideration three existing buildings in Albania. The aim of this research is therefore to identify barriers that affect the adoption of BIM technology in Albania, where the disciplinary users will be included, project lifecycle stages, digital visualizations–including software utilization—and organizational issues such as scheduling and sequencing. Also, BIM is being used in the Albanian industry, from a majority of private sectors. Our aim is to come up with a proposal for a BIM pilot project, related to the public sector, emphasizing the benefits and barriers that have to do with Cost, Time and Quality. The conclusions define that BIM's beneficial aspects are a key step toward the future of the AEC industry after the pandemic time. According to the respondents, the use of BIM during the pandemic period helped a lot in terms of project management, and coordination and improved the workflow in architectural and engineering companies. They seem to be quite positive about BIM's impact on future projects.

KEYWORDS: BIM, Building information management, Construction project management, BIM tools, BIM Manager, BIM Coordination.

INTRODUCTION

Before using the BIM system, architects and engineers used to produce the drawings on paper. Only during the 80s, did they switch handmade drawings with advanced technologies using Computer-Aided Design.

BIM has its roots in 1975 with Charles M. Eastman based on an article he wrote about the documentation of all the drawings (map, plans, facades, section) in the same document. During the ’70s and ’80s, BIM was used only in a commercial way. A. van Nederveen and F.P. Tolman were the ones that used Building Information Modeling as a term in research. Autocad was one of the first most used programs (20 years) until 2002 when Revit was acquired. Yet, the new generation of architects and engineers are pushing the boundaries toward BIM, as the new normality in future projects.

The US National Building Information Modelling Standard defines BIM as; "Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility (GSA BIM Guide Series 01). A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition. It is predicted to be the predominant design and management tool used to design, review, approve, build, commission and operate buildings (Knight, M. D. 2008). The concept of (BIM) is also defined as a work methodology which is seen as one of the greatest revolutions in the architecture, engineering and construction industry (AEC). This study is a critical reflection on the integration of BIM in the construction industry in Albania, as it has recently experienced a prominent transformation. It started with paper drawing, then in two-dimensional and three–dimensional Computer-Aided Design which still is not enough for further analysis, information exchange, and model optimizations. Building Information Modelling has become an inevitable solution, even though not a widely used and challenge-oriented tool.

BIM is however not a goal in itself but rather a tool to enable this higher productivity (Lindblad, H. 2013). The motivation for this study is shown in Figure 1.

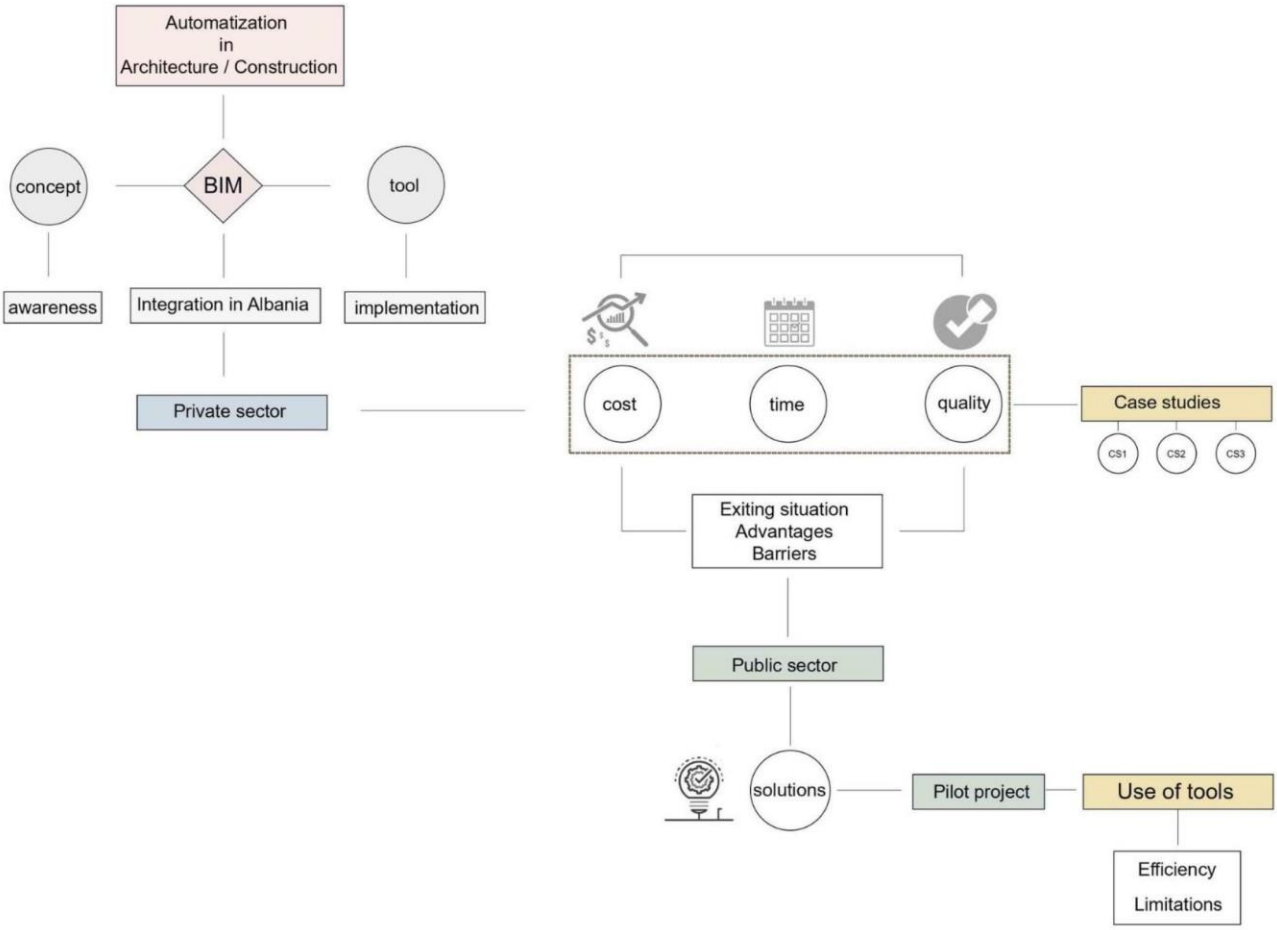


Figure 1. Motivation

PROBLEM DEFINITION

First of all, construction specialists and architectural companies are still not used to the conception of BIM as they limit the process within the framework of methods they are used to. They find this implementation to be risky, expensive and difficult. The implementation of BIM can provide great

benefits, these changes, however; require a substantial change of the traditional ways of working (Arayici et al. 2009) Second of all, the use of BIM needs a new strategic way when it comes to coordination of the construction project. This new approach will have consequences on changes and results, on which the Albanian Construction is sceptical of BIM usage. New approaches and strategies have to be taken into consideration.

METHODOLOGY

Because of the very nature of this study, quantitative methods will take place. The goal is to conduct a set of questionnaires providing deeper and factual responses where general questions will be asked about the actual building process, their current definition of BIM or reasons for not applying BIM, or identify their first impact on BIM usage, the software they use, the risks and benefits they have faced during the process. In this research, online surveys with standard questions will be delivered via email, for each firm such as VARKA arkitekture, Commonsense studio, Arkon studio, Kaso construction, Kastrati construction, Archea studio, Kontakt etc.
Such qualitative observation will be taken from interviews with architectural, construction companies and BIM professionals. As Seaman (1999) states, these types of methods are used to collect qualitative data based on opinions or impressions about a specific topic. The selection criteria for the three case studies (Mangalem21, Tirana Downtown1 and Air Albania Stadium) were based on the unique typology that they have because, in diverse typologies, BIM acts differently.

SURVEYS

Building Information Modelling is presented as the next evolutionary link in project delivery within the AEC Industry. (Gray et al,.2013) has reported a large-scale electronic survey of BIM implementation in Architecture, Engineering and Construction projects not only in Australia but internationally. The surveys were delivered to architectural and construction companies for each phase of the design. After analyzing the data gathered from the respondents, the results show that architectural studios are more likely to use BIM in the design phase as shown in Figure 2.
In the Pre-Design Phase, other tools were used to elaborate the model.
Also, BIM was used not only to generate the 3D model and other drawings, but it was a tool that improve the coordination and the collaboration between stakeholders, protect the information and improve the building performance.
On the other hand, Construction companies were aware of the usage of BIM, in terms of coordination, protection and project delivery. Still, it is a complex work where cannot be found a lot of BIM managers and project coordinators work under BIM. Hence, both the architectural and construction companies recommended its implementation and integration in future projects in Albania as e need for improvements at work and quality of the object.
For instance, in the design phase, 14.3% had general knowledge about BIM tools but did not use them. 35.7% had some tools with expertise and 28% of them used only one tool with adequate knowledge. Still, only 23% used one tool to develop cost analysis and schedule in this phase, and 15% used one tool with expertise to promote comparative energy analysis.

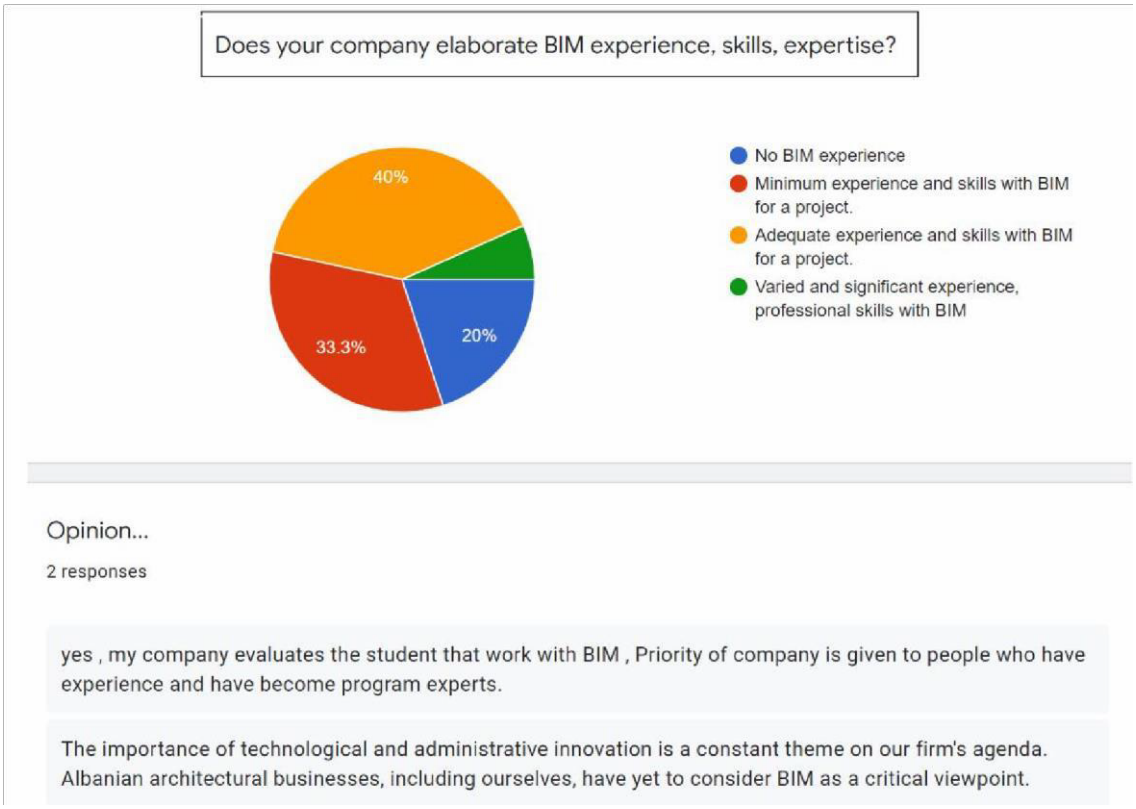


Figure 2. Survey

Construction companies recommended BIM implementation to a higher degree than the architectural ones. 50% definitely recommended its use, and 50% were very unlikely to recommend it. Also, 55% of them were convenient using BIM during the pandemic time, when it comes to coordination in the project.

CASE STUDIES

Mangalem 21

It is a Residential block in Tirana, proposed by the Dutch firm OMA. The project was conducted with BIM guidelines and Arch. A. Gusho explained in detail the process, the benefits and the challenges that the company has been involved in this time. In this case study, BIM Revit was used mostly in the design development stage, where accurate plans and sections were drawn with details, specifications and dimensions. The sharing process of the files with other stakeholders was much easier, and the changes were made in real-time. During the construction phase, such tools were used to control the cost schedules avoiding so errors, and keep continuous control of time efficiency. The benefits of the project are expressed in the diagram below Figure 3.

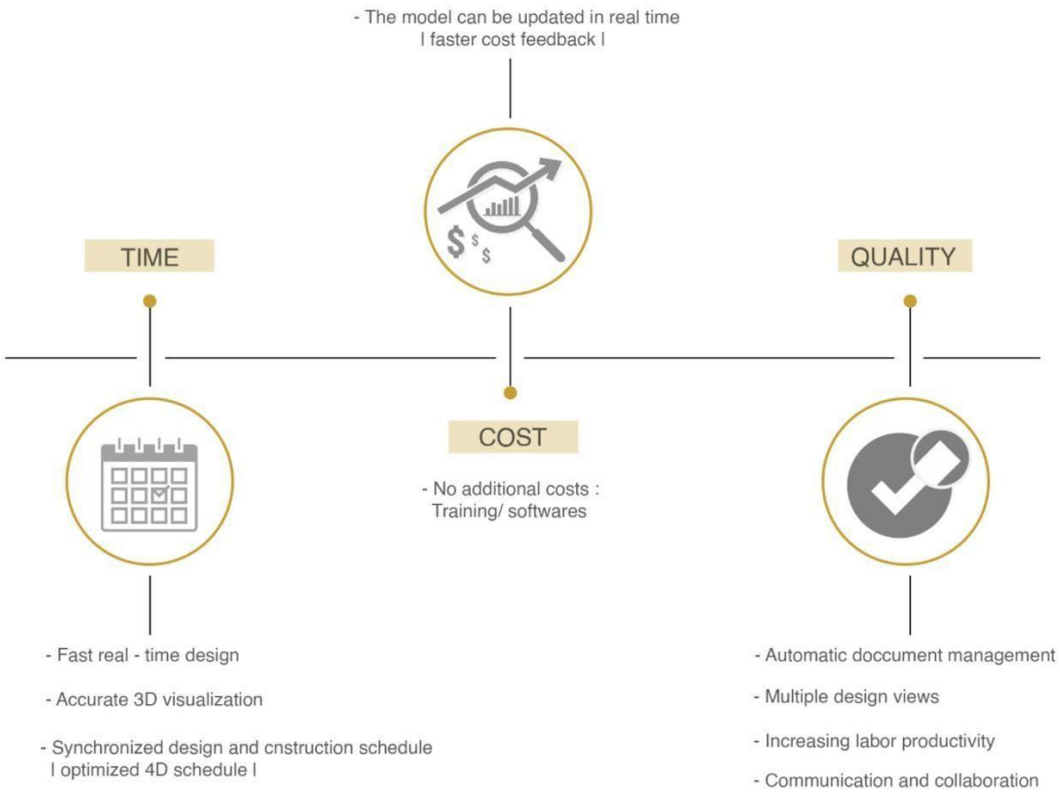


Figure 3. Benefits of BIM in the project.

Air Albania

Air Albania is the new national stadium as a mixed-use building in Tirana, constructed from Albstar in collaboration with Marco Casamonti, an Italian architect.
The 2D drawings were produced via AutoCad and the mass model in Revit and were delivered as dwg and pdf files. At this point, Albstar was required to continue working with BIM Revit. This method had its challenges and benefits;

- **First of all, it was a new concept and not everyone was an expert in BIM knowledge. Also, this project includes an enormous number of teams and members, and every single one of them needed a new clearly defined building execution planning.**
- **A lot of architects turned to autodidacts in learning Revit and being used to conclude all the project materials there. Doing so, no extra cost for professional training and software access was needed.**
- **A lack of coordination happened during the MEP models, as team members of this drawing phase, had little or no knowledge of BIM Revit.**
- **On the other hand, some architects of Albstar, emphasized the fact that using such a new program, was very productive and helpful when it came to project delivery of information exchange.**

As Revit can be linked with other software, a huge number of workers had the possibility to coordinate in real-time with each other and avoid errors in time without extra cost.

Downtown One

It is a mixed-use typology, a project developed by MVRDV and our local partner DEA Studio. It is designed on behalf of Kastrati Construction, with the European standards and quality of the building. Having applied the BIM protocol based on the guidelines and frameworks that were previously set

up, the influence toward an efficient production was really high. To obtain and deliver an accurate virtual project, based on BIM standards and technicalities, each project partner charges a BIM coordinator who is in direct contact with the BIM Manager of the company, as shown in Figure 4. Using multi-tasking software such as Revit, other analyses such as clash detection and fire safety were made based on the actual model. On the other hand, Revit Insight clearly generated solar analysis, energy performance, acoustic performance and optimization.

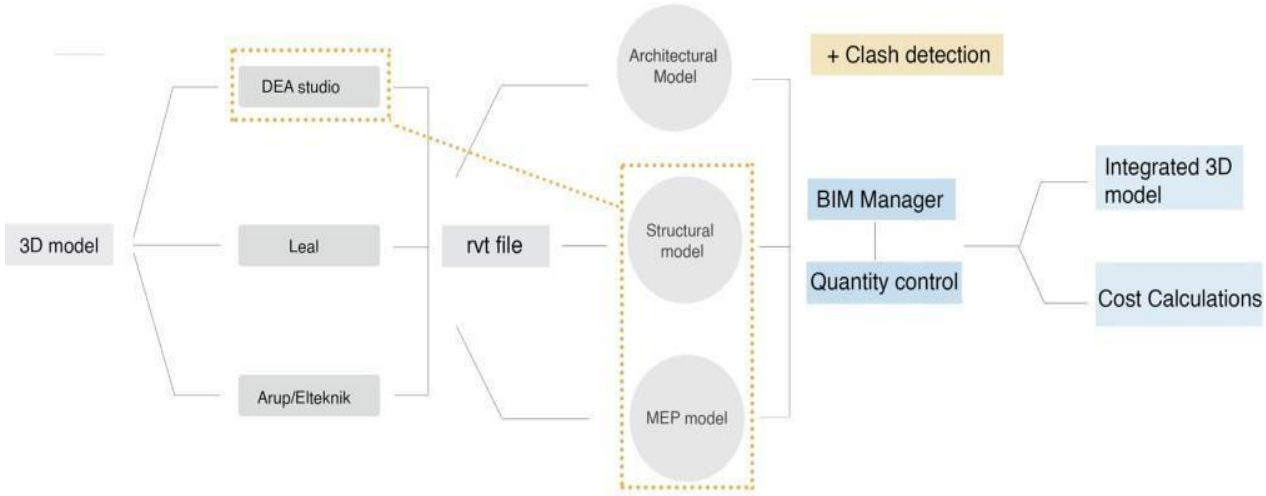
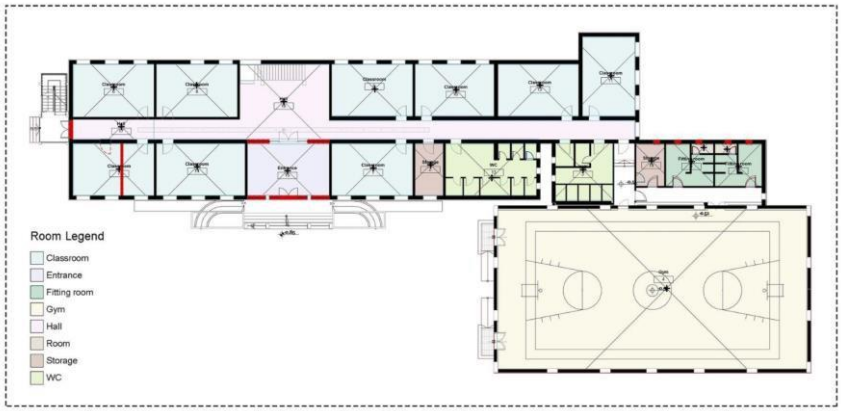


Figure 4. Team coordination in the project

PILOT PROJECT

This BIM pilot project concerns a public high school located in a small city in Albania, called Bilisht. First of all, the project aims to implement BIM tools which support the construction phases, performing so advanced analysis for better design decisions. Second of all, it will be used to ensure the positive impacts to the public client in terms of time-saving, cost efficiency, error reduction and high-quality improvement. 3D Model is drawn in Revit, separated into phases (New Construction/Demo), where wall, window and room schedules are listed in Figure 5. Certain BIM validations will be involved using Revit for the 2D and 3D model, energy and solar analysis, material take-off, and clash detection identification using Naviswork as a tool, shown in Figure 6.



<Room Schedule>

A	B	C	D	E
Number	Name	Perimeter	Area	Volume
1	Classroom	2495	37 m²	Not Computed
2	Storage	1542	14 m²	Not Computed
3	WC	2151	29 m²	Not Computed
4	Gym	9181	446 m²	Not Computed
5	Fitting room	2546	15 m²	Not Computed
6	Classroom	2509	38 m²	Not Computed
7	Classroom	2485	37 m²	Not Computed
8	Classroom	2543	38 m²	Not Computed
9	Classroom	2494	37 m²	Not Computed
10	Classroom	2455	36 m²	Not Computed
11	Classroom	2470	37 m²	Not Computed
12	Classroom	2487	37 m²	Not Computed
13	WC	3284	42 m²	Not Computed
14	Classroom	2690	42 m²	Not Computed
15	Entrance	2559	38 m²	Not Computed
16	Hall	10564	124 m²	Not Computed
17	Hall	1895	14 m²	Not Computed
18	Fitting room	2586	16 m²	Not Computed
19	Storage	1343	11 m²	Not Computed
20	Room	618	2 m²	Not Computed
21	Room	627	2 m²	Not Computed

<Wall Schedule demo>

A	B	C	D	E
Family and Type	Length	Phase Demolished	Volume	Width
Basic Wall: wall 25	531	New Construction	3.62 m³	25
Basic Wall: wall 25	531	New Construction	3.72 m³	25
Basic Wall: wall 25	531	New Construction	3.72 m³	25

<Wall Schedule -New>

A	B	C	D	E
Family and Type	Volume	Width	Length	Phase Created
Basic Wall: wall 12	0.89 m³	13	401	New Construction
Basic Wall: wall 12	0.53 m³	13	168	New Construction
Basic Wall: wall 12	0.53 m³	13	168	New Construction
Basic Wall: wall 38.5	1.62 m³	39	168	New Construction
Basic Wall: wall 12	1.22 m³	13	346	New Construction

Figure 5. Room Configurations and wall schedules.

In this case study project, the clashes were identified between surfaces with different characteristics such as a clash between a wall and a beam occupying the same space, wall and the floor or floor and column. Positive advantages were visible while using Navisworks for clash detection:

- **Help to clearly identify the interferences between elements in the project. Linked directly with Revit file (rvt), it was time efficient while refreshing the models and exporting the changes on time.**
- **The quality of the model has improved anytime that errors are found.**
- **It is helpful for the public sector to avoid errors before building on-site, while making continuous checking, reducing so extra and unpredictable costs.**
- **It can be shared with other stakeholders like architects, engineers, and MEP system specialists to work on the attached problems addressed to them.**
- **Also, other sophisticated clashes can be detected: Mechanical, Plumbing,**

Electrical Lighting components, Water Piping or Fire Suppressions System.

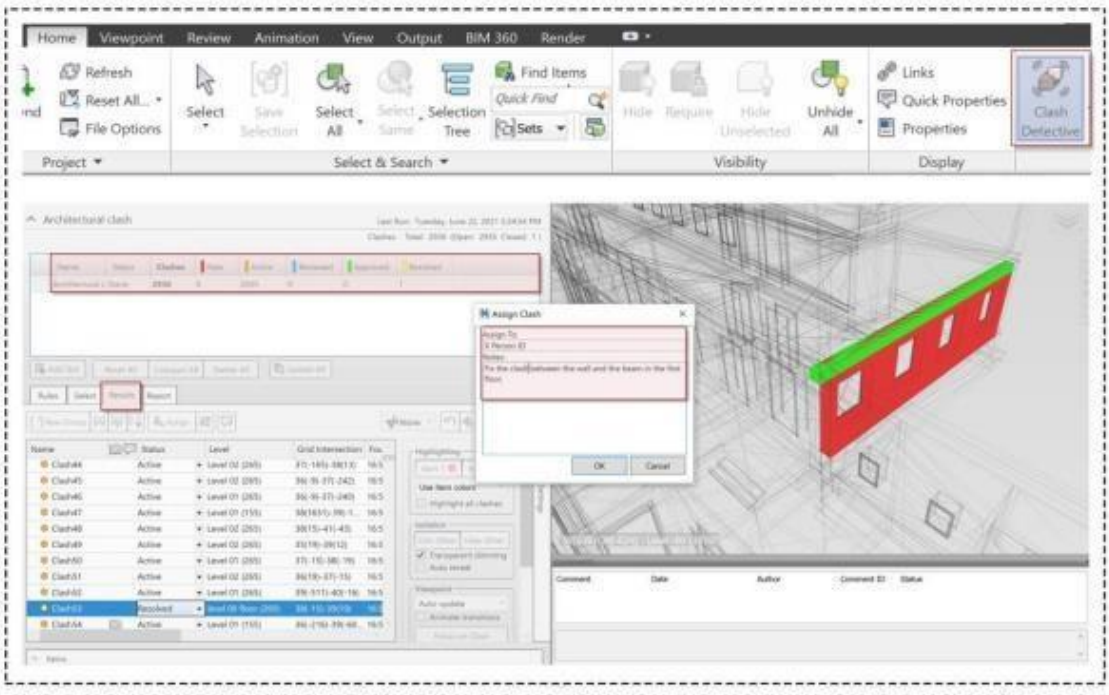


Figure 6. Clash detection

Hence, one major concern of BIM clash detection implementation is the absence of knowledge from members, and the cost of the software which needs to be bought. One of the aims of proposing this BIM pilot project as an example for further developments in the Albanian industry is to identify the potentials that 4D BIM has in the lifecycle of a project. Such project scheduling, pushes the public sector towards the more efficient cost and time control, underlining so the immediate need for structuring the guidelines and standards different from the traditional ones. Hence, this High School case study presents Building Information Modeling as a promising tool for architects and engineers in the public sector, which will boost the need to formulate a BIM Execution Planning and improve the quality of future projects.

Timeline in Navisworks is an option which helps the architects and engineers with construction sequencing. After adding a task, the timeframe that it is going to occur is set up, notifying the type whether it is an existing, demolished, adder or existing to remain element. The appearance configuration of each of them is shown in different colours and transparency values as shown in Figure 7. Generating such a detailed working plan, help the team members coordinate with each other. Also, different from the traditional method, it is possible to view the virtual model in various sequences of time, making so changes, avoiding errors and better managing the time one the Actual and the Planned time is analyzed in Gantt Chart. All the members can be linked to the file and keep up with the process.

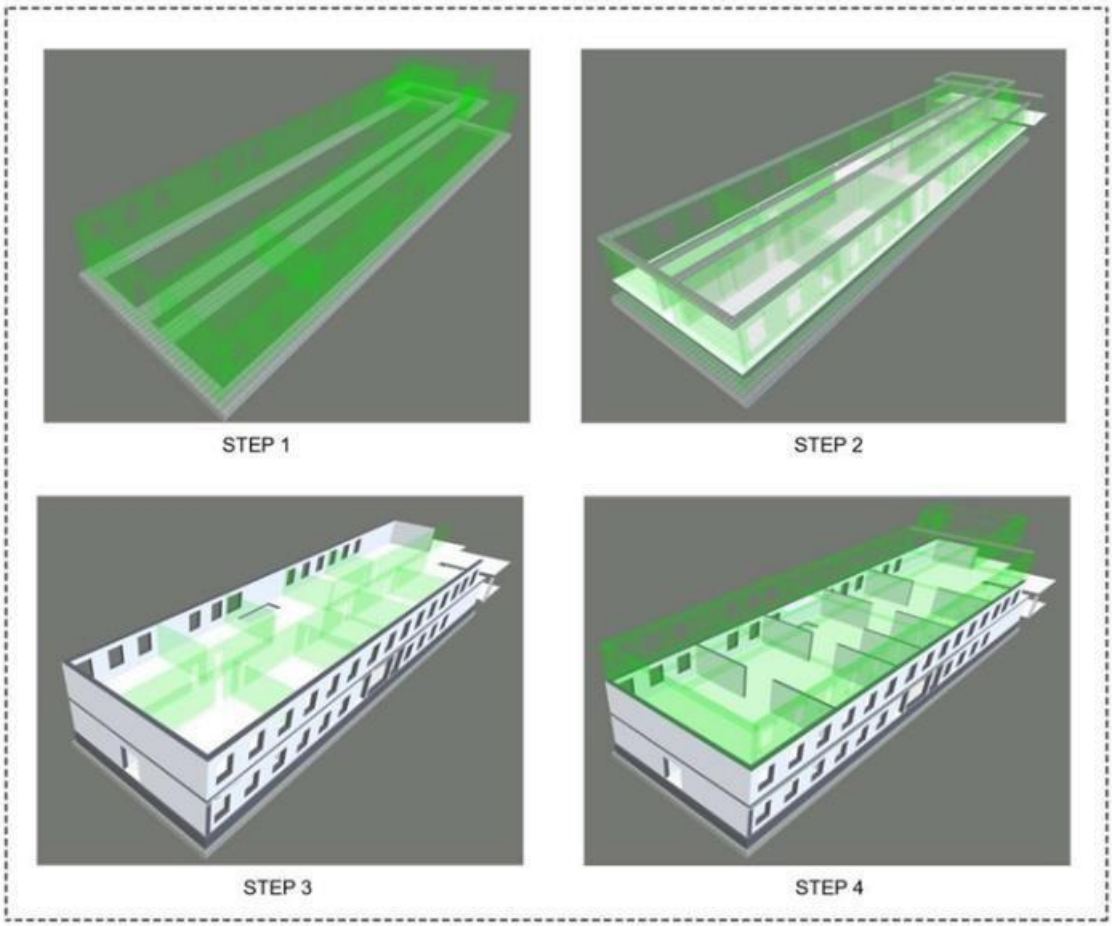


Figure 7. Timeline in various steps

CONCLUSION

At a first sight, implementing BIM might look like a very complex process for those that have limited or no knowledge in the field of BIM. However, clients and contractors need to look closer at the BIM benefits and transform some of the traditional methods that they are used to working with. New strategies need to be elaborated and a clear plan for how the project is going to be executed.

First of all, after collecting the results from the online surveys delivered to construction and architectural companies, it was seen that the Albanian Industry is already aware of the existence of BIM as a concept and as a vital tool. A considered number of private architectural studios use BIM in the design phase continuing so in the construction phase. Meanwhile, the construction companies are complex organizations with a lot of stakeholders and labours that need to be trained for this new way of working. Still, they have incorporated the use of BIM in the construction phase, improving so coordination, maintenance, quality of the building, controlling time, cost and quality. Even though private companies are getting used to BIM implementation, the public ones are still using the traditional methodology. (Eadie et al.,2014) Among many benefits linked with BIM application, there is also a list of barriers, that prevent BIM usage from different stakeholders

Secondly, the case studies chosen for BIM evaluation and proficiency in the three existing buildings in Albania presented the benefits that they faced while working with such tools. Except for the advantages mentioned before, limitations like training the staff, absence of knowledge from labours, and the extra cost of the software are still a barrier until we fully use BIM with all its potential.

In this paper, an existing building was taken as a case study to demonstrate to the public sector how an entire project can be executed through BIM tools. According to other literature studies, two were

the software used as the excellent ones to manage the High School project. From 2D drawings in CAD, the 3D modelling was constructed in Revit. Plans, sections, facades, phases, scheduling/quantities and solar analysis were generated. Then the Revit file was linked with Navisworks manage to navigate in the project, simulate the clash detection, renderize the model and simulate the timeline. The use of these two superior software of BIM, indicate a clear framework of its necessity for a better presentation of the project, increasing so the quality, simulating the cost, avoiding errors, and controlling the time. It was a case study presenting the potential of BIM, that its interoperability matters, and can improve a whole project, from the design phase to the post- construction. (Wiley et al., 2015) BIM is presented as "the right tool for the right job." It also gives a clear panorama of how helpful it is to work on reconstruction projects, working with phases, checking for clashes and building in an efficient way. All in all, BIM's application is vastly used in 3D models with construction schedule management, project cost estimation, effective visualization, clash and collision detection, and simulation of total project time (YAN et al.,2014).

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