Exploratory study on use of BIM in construction sector in Romania

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Abstract

The adoption of Building Information Modelling (BIM) is increasingly recognized as a crucial development in the global construction industry, offering significant benefits across the stages of design, execution, and lifecycle management. In Romania, however, the widespread use of BIM remains limited, with a clear disparity between the theoretical advantages highlighted in research and their actual implementation in practice. This exploratory study examines the challenges hindering the broader adoption of BIM in Romania's construction sector. Using a mixed-method approach, which includes both surveys and semi-structured interviews with industry experts, the research identifies key obstacles such as limited expertise and resource limitations. Findings indicate that larger companies, particularly in urban centres like Bucharest, are more likely to adopt BIM, while smaller firms continue to face substantial challenges. This study adds to the expanding literature on BIM adoption, providing valuable insights for both academic researchers and industry professionals.

Keywords: Building Information Modelling, engineering, challenges, construction companies

1. Introduction

The digitalization of society is an ongoing process, and in most developed countries, government policies have been implemented to stimulate and support these transformations. In Romania, one of the most frequently discussed opportunities associated with digitalization in the construction sector is represented by building information modelling (BIM). Since the beginning of the 21st century, BIM has gradually established itself as an essential tool among researchers, decision-makers, and professionals in the construction industry and has been recognized for its various advantages in terms of design, execution, and lifecycle management of buildings. Recent studies [1] increasingly highlight the use of BIM in the development of sustainable constructions. At the same time, beneficiaries are attributed a central role in promoting innovation through the use of BIM [2]. Nevertheless, despite these advancements, BIM is not yet widely applied in most residential projects, and the benefits identified by researchers are not leveraged to the expected extent [3].

In fact, although BIM is perceived as a solution to the numerous challenges and modernization requirements in the construction sector [4], an increasingly evident gap is observed between the advanced BIM solutions described in the specialized literature [5,6,7,8] and their actual implementation in the industry [9]. This research aims to investigate the causes of this gap by analyzing the difficulties and obstacles encountered in the current use of BIM in Romania's construction sector. The existing literature already examines the use of BIM, its potential benefits, as well as the barriers to its implementation, considering various industry stakeholders, that are in charge of design, execution, and facility management. However, few studies investigate the extent to which the anticipated benefits are achieved in practice and the reasons for this [10]. Thus, this study aims to supplement existing research on BIM by focusing on its practical opportunities and benefits from the perspective of specific tasks and roles within the construction sector.

The main objective in the current article is to compare the anticipated benefits of using BIM with those actually obtained, while discussing possible explanations for why certain advantages were obtained, while others were not. The essential contribution of this research resides in providing a critical analysis related to BIM and its strengths, going beyond the predominantly technological perspective adopted in previous studies.

2. Methods

In order to investigate the use of BIM and its benefits, in view of identifying possible explanations for the current level of understanding and achievement of these benefits in Romania's construction industry, we conducted an exploratory analysis, which combined quantitative and qualitative methods. Thus, we used a non-representative survey of convenience, with experts from the field, as quantitative approach, followed by individual semi-structured interviews, as qualitative approach.

The questionnaire included questions related to familiarity and interest in using BIM in the company, ways of acquiring know-how related to BIM, types of BIM software used, advantages and challenges related to use of BIM in their company. The individual interviews (8) focused on obtaining further information on the advantages and challenges, as perceived by the experts interviewed, with application in their company.

Data collection was organised in May 2024, during a specialised event dealing conference on the digitalization of construction, held at the Technical University of Civil Engineering in Bucharest. The questionnaire was offered to a single representative from each company, whose primary field of activity is construction. Bias in the result may be generated by the limited number of companies participating in the conference, by the predetermined profile of participants accepted to participate in the event. The non-random selection of respondents took into account the need to have respondents

with various profiles within the construction sector (building design, execution of works, facility management, construction materials providers), as well as different company sizes, geographic locations, project scales, and employee numbers. The total number of respondents (valid questionnaires applied) was 20, with potential to deepen this study in future events of the same profile held in Romania.

In addition to the survey, eight individual semi-structured interviews were conducted with participants with same profile as the participants in the survey. The main aspects approached during the interviews focused on advantages and challenges related to the use of BIM in companies from the construction sector, with different size, different geographic location.

Methodological limitations and possible improvements

1) Sample size - Limited number of participants

The number of respondents to the case study is 20 companies, larger number may contribute to more meaningful connections and fair representation. The respondents and experts interviewed in this case study were representatives from companies present at the UTCB conference, so access was somewhat restricted. Despite this constraint, however, as these companies are among the most relevant in the construction sector (companies name: PORR România, Popp și Asociații, Construcții Erbașu, Rotary, Strabag, Leviatan, Ubitech, Xplorate, Ness Project Europe, Sixense, Saidel, AllBIM, Graitec), the findings are still reliable and valid. Their expertise in the field may be considered sufficient to compensate for limited numbers.

2) Time constraints

The majority of respondents completed the questionnaire during the event, therefore there is a restriction on the time available and a future investigation is recommended to allow more time for the study participants to respond. In order to counter-balance this limitation, the interviews were conducted, in view of gathering additional inside into the topic at hand.

3) Limited number of questions used for data collection

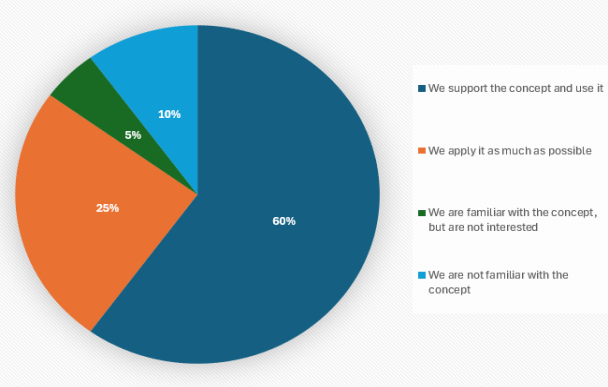
The method used for data collection is a questionnaire in Microsoft Teams Forms, composed of 15 questions. The shortcoming was the number of questions asked, which did not allow a comprehensive evaluation of the findings. Such approach was partially compensated by use of semi-structured interviews for some aspects of interest with experts. In the future, a more in-depth

approach for data collection, more comprehensive, containing a large number of questions together with other methods that would make the questionnaire better, may be considered.

3. Results and discussions

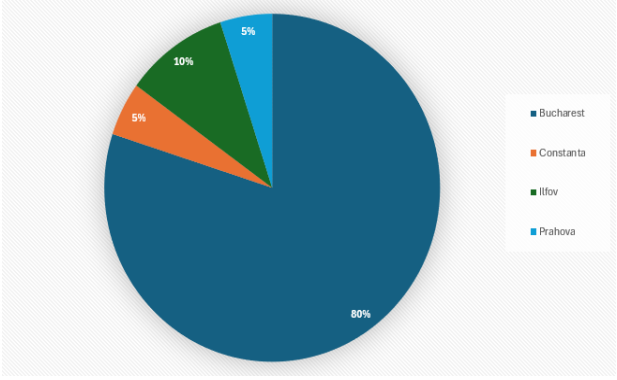
What we can observe is that, out of the 20 construction companies surveyed, only 10% are not familiar with the concept of BIM, while the majority, 60%, implement BIM in their projects.

Figure 1. Percentage of companies using BIM



As shown in Figure 2, the sample includes respondents mostly from Bucharest, with additional respondents from other counties. Of these, 15% are small companies with 1 to 10 employees, 10% are medium-sized companies with 11 to 49 employees, and the remaining 75% are large companies with over 50 employees, reflecting the same regional distribution: 80% from the Bucharest area, 10% from Constanța, 5% from Ilfov, and 5% from Prahova. Regarding the necessity of using BIM to improve efficiency in the construction sector, all the surveyed companies responded affirmatively. However, among small companies, it is observed that approximately 33% use BIM only when it is required.

Figure 2. Classification of companies according to their geographical location



In 60% of the cases, individuals acquired BIM knowledge through internal training within the company, while 20% gained it through external training—of which 15% took place during working hours and 5% outside of them. Additionally, 15% already possessed BIM knowledge prior to joining the company, and 5% of the respondents stated that they had not acquired BIM knowledge in any form.

Figure 3. Categorization of responses on the need for BIM concept according to company size

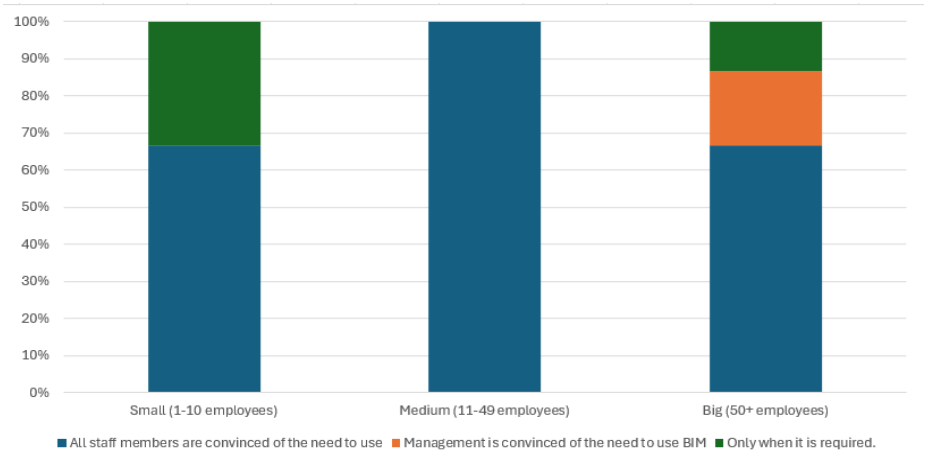
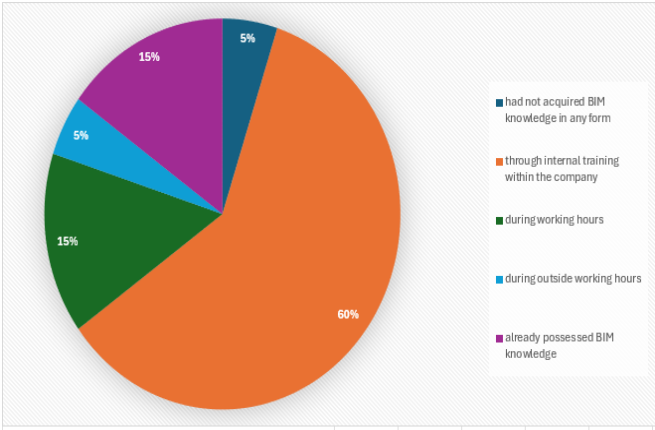


Figure 4. Percentage on employee training



Regarding the use of BIM software, among the surveyed companies, Autodesk Revit is predominant, with approximately 65% of small companies and 75% of large companies using it. In the case of medium-sized companies, there is a majority preference for Allplan.

Figure 5. Classification of BIM software responses by company size

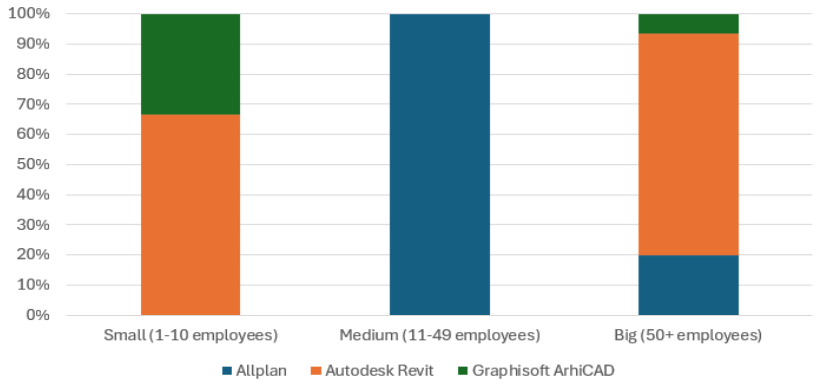
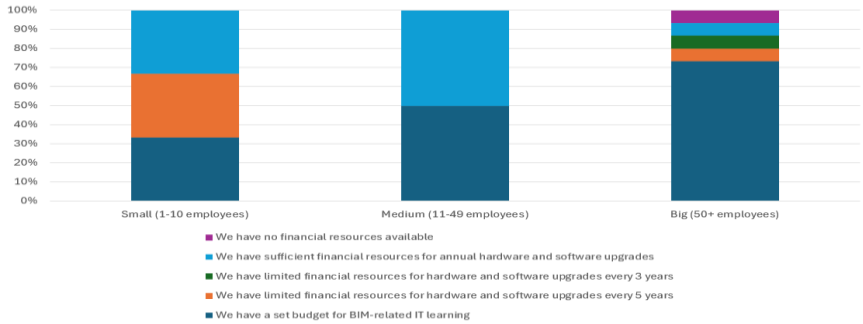
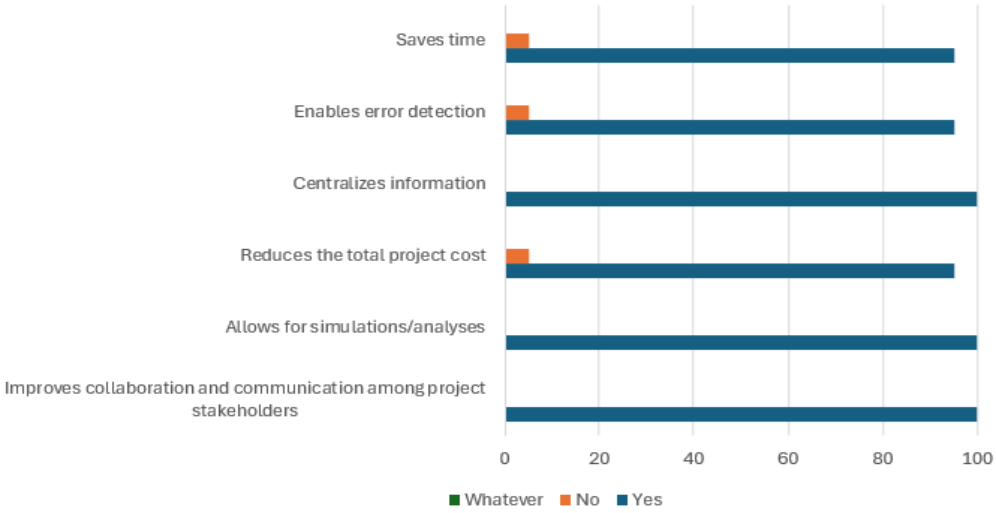


Figure 6. Ranking of responses on IT investment budget by company size



Concerning the advantages of using BIM for improving efficiency, respondents were asked to share their views on the following potential benefits, as shown in Figure 7.

Figure 7. Percentage of answers on the advantages of using BIM



Based on the figure below, which illustrates the responses as percentages, we can conclude that nearly 100% of the responses regarding these advantages were affirmative across all companies.
Following-up on this aspect of the survey during interviews, it was of interest to observe that while during the survey all respondents agreed on the advantages, during the interviews, interview respondents belonging to companies active mainly in the area of design of structures mentioned a number of advantages similar to those from Figure 7, compared to those in the field of execution, where in addition to the advantages, they also presented some disadvantages, the main ones being those related to training people on the use of technology in real time at the point of work and digitization of documentation.
The advantages identified and presented in Figure 7 have been pointed out also in other research studies [11, 12].This shows that advantages in the construction sector have been generally identified and agreed upon in literature, as well as in practice. Thus, BIM technology facilitates efficient collaboration between all parties involved in a project. It enables real-time construction status updates, ensuring that all engineers and designers are constantly informed about progress on site. This improved transparency and communication helps synchronize efforts and optimize workflow.
Moreover, the experts interviewed pointed out that the use of BIM helps reduce design errors through detailed simulations and rigorous analysis. Thus, many of the experts interviewed mentioned that these design tools not only identify potential problems before they affect the physical construction, but also minimize the costs associated with field corrections, which was also highlighted in recent studies, such as [13]. As a result, overall project costs are significantly reduced. In addition, BIM technology shortens the time needed to complete construction by facilitating early error detection and centralizing information. This leads to more accurate planning and efficient resource management.[14]

5. Conclusions

In conclusion, this study highlights a key role that Building Information Modelling (BIM) technology may hold in modernizing the construction sector in Romania. This combined survey and personal interview method helped to refine the results more precisely.
The current study pointed out that larger companies, particularly in urban centres like Bucharest, are more likely to adopt BIM, while smaller firms continue to face substantial challenges. The analysis identified both advantages and some obstacles related to use of BIM, such as limited expertise and resource limitations.
Compared to traditional methodologies, BIM offers substantial benefits, including a significant

increase in efficiency and quality. Ultimately, BIM is proving to be an essential support for efficient and sustainable construction, helping to reduce the environmental impact of construction projects. By improving coordination and reducing the waste of materials and resources, BIM asserts its place as a fundamental pillar in the future of construction [15]. Thus, the adoption of BIM technology is not only advisable, but essential for progress and sustainability in construction [16].

This exploratory study could be continued with an approach on the Digital Twin concept and his benefits in the construction sector, together with an improved method of data collection, much more comprehensive, which would contain a larger number of questions allowing a better interpretation of the results.

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