Hindawi
Advances in Civil Engineering
Volume 2023, Article ID 2629608, 11 pages
https://doi.org/10.1155/2023/2629608

Research Article

Contract Conditions and BIM Use Effectiveness to Improve Project Performance

Francisco Villena Manzanares[1], **Tatiana García-Segura**[2] **and Eugenio Pellicer**[2]

[1]*Design Engineering Department, Polytechnic School, University of Seville, Sevilla 41011, Spain*
[2]*Construction Project Management Research Group, School of Civil Engineering, Universitat Politècnica de València, València 46022, Spain*

Correspondence should be addressed to Francisco Villena Manzanares; fvillena@us.es

Received 24 November 2022; Revised 13 July 2023; Accepted 25 September 2023; Published 21 October 2023

Academic Editor: Heap-Yih (John) Chong

From a technological point of view, a huge potential can be found in building information modeling (BIM) in order to significantly improve the performance of a project. However, the literature review could not provide conclusive results on the impact that contractual practices may have on how effective BIM may result in technological terms, as well as outcomes within a project itself. The aim of this research is to determine the impact contractual conditions have on the link between BIM use effectiveness and the performance of a project. A self-administered survey was distributed to project design managers within architecture, engineering and construction engineering (AEC) firms. Using the partial least squares structural equation modeling (PLS-SEM) method, 92 answers were analyzed, finding contractual conditions to be mediating. These results show that appropriate conditions set in a contract with regard to handling BIM technology have a positive impact on the performance and outcomes of a project. The results, however, are only based on Spanish companies, meaning they may not necessarily be applied in global terms due to the cultural differences there may be within countries and continents, which should also be taken into account in the construction phase. Senior managers and policymakers could greatly benefit from the abovementioned findings with regard to improving contractual conditions in project design management in a BIM context, helping remove any source of conflict. It has been suggested by researchers that a gap has been found in BIM contractual practices literature, affecting not only BIM implementation but also project performance, thereby contributing to an improvement in BIM practices in construction contexts.

1. Introduction

The use of building information modeling (BIM) is currently at its peak in Spain with regard to designing architectural, engineering, and/or construction projects. However, the literature review did not provide conclusive results on how contractual practices (the conditions and characteristics of the BIM contract) can influence BIM use effectiveness and the subsequent project performance. BIM methodology, which is regulated by UNE-EN-ISO-19650 standards, takes part in all aspects of a project, from design to construction, project management, or even marketing, among other steps.

A lack of protocol or technical specifications outlining BIM model esthetic and technological needs in order to be fully useful and cost-effective, consequently, results in failure. However, the effects of BIM on contractual practices and project performance still need further investigation [1]. In this regard, the authors state that appropriate contract conditions should include both obligations and responsibilities between contracting parties to achieve successful BIM implementation [2]. In addition, the emergence of new professionals in BIM contexts (BIM managers, BIM coordinators, BIM specialists, BIM modelers) can be beneficial to comply with the protocols established in contractual practices due to their level of implication and commitment regarding effective BIM technology and methodology use. According to other authors, people who work with BIM technology vary depending on the stage of a project meaning different professional skills are required. Because of that, two forms of leadership are needed: both BIM management and project management [3].

BIM technology offers many possibilities in the design of construction projects. However, the legal context specified in the contract conditions (model deliverables) must be considered. In reality, considering the uncertainties that one may come across, conflicts and issues arise, essentially requiring a legal context to be found in BIM design contract conditions. The issues in the practical application of BIM are not necessarily related to its methodology (although collaboration is not yet as desired) nor to the capacity of BIM software. More specifically, the issues encountered in the practical application of BIM relate to its effective use, i.e., effective implementation within a legal context. Therefore, the characteristics and conditions of the contract are responsible for the design objectives and specifications of the BIM model. The aforementioned issue, i.e., the impact contractual practices have on how effective BIM may result in technological terms, is a clear example of a conceptual framework, which justifies the purpose of this study given the challenging nature of implementing BIM in construction projects. Through quantitative research, a model is proposed to try to explain whether BIM design and specifications adequately align with objectives set in a contract.

This study analyzes the above influences on project performance in order to set objectives within a contract. Taking into account the fact that this research also analyzes the effects project performances experience, the research question that this study aims to answer is the following: What impact do contract conditions have on BIM use effectiveness and project performance?

To answer this question, this research examines the links between contract conditions and characteristics, BIM use effectiveness, and project performance in a BIM context with the use of the partial least squares structural equation modeling (PLS-SEM) method, using 92 project manager responses to a previously elaborated survey.

In the second section, a literature review is summarized. Next, in the third section, hypotheses are presented, as well as research relevance. The following section deals with the research method. In the fifth section, results are displayed, whereas in the sixth section, results are discussed. Finally, in the seventh section, conclusions are drawn, including contributions and limitations of the research.

2. Literature Review

The literature review was conducted using three databases (Scopus, Web of Science, and Google Scholar), considering the combination of keywords: "BIM," "contract," "use effectiveness," and "project performance." The authors selected the most relevant contributions related to BIM that dealt with any of the variables of the quantitative research model. The use of BIM is rising in popularity in the world of AEC given [4] the benefits it brings to intelligent problem solving (planning, material quantity, and cost) and time saving in managing information and sharing knowledge among all construction participants [5–7]. BIM offers great potential to significantly improve project performance from a technological point of view because it can be integrated with other emerging technologies [8]. The use of BIM, also known as virtual design and construction (VDC), can offer a wide range of benefits to infrastructure project life cycles, including design, construction, and operation, via processing information sharing with the aim of facilitating the decision-making process within a project [9, 10].

Simultaneously, project management in BIM contexts has received more attention from academics and practitioners around the world [8] because BIM and its integration remain a challenge to provide solutions and integrate BIM effectively into project management. For some authors, BIM has become the ultimate technology for construction project management [11]. The literature has shown that there are BIM implementation problems due to communication failures between different software used in the same project. An example of this is when there are no established protocols and there are failures in the management of Industry Foundation Classes (IFC) data information, with information disappearing from the BIM model when working with different software. This may have an impact on BIM project performance [12]; therefore, the BIM model must allow to extract and manage the necessary information (graphical or nongraphical) according to the protocols established in the contract. In this regard, the legal aspects within BIM contexts must be established in design phase, where both workflow and data modeling deliverable are defined. This suggests that BIM use effectiveness has an impact on project performance when established guidelines on its use and management are included in contract conditions.

BIM methodology proposes a series of new functions that undertake new roles when clauses which forge BIM to mandatorily be used are included. In the Spanish AEC industry, it is compulsory to work with BIM in the design phase of projects, including public administrations and, gradually, private organizations. Ultimately, the adoption of BIM in project design is a strategy to digitize the construction industry, but uncertainties exist regarding the legal context in which BIM is fully promoted in design phase due to existing conventional construction contracts not being adapted to the collaborative approach of BIM [13]. The collaborative approach refers to integrating each stakeholder in their own discipline with other disciplines on one single BIM model, sharing information on a single platform with common data environment (CDE) according to a study by Sacks et al. [14] and ISO [15].

2.1. BIM Contract Conditions. On the other hand, in construction, there are many different types of project delivery methods where its process is established and classified according to a study by Pellicer et al. [16]: design-bid-build (DBB), design-build (DB), construction management at risk (CMR), and integrated project delivery (IPD). These project delivery methods can be organized into two categories according to a study by Ren and Zhang [17]: (1) design and construction being combined in one contract (such as DB and IPD) and (2) design and construction contracts being separated (such as

DBB and CMR). In practice, the selection of the best project delivery method depends on many factors, such as the type and complexity of a project and the experience and preference of its owner, as well as other parties, who can be interested in establishing combined or separate design and construction contracts [18]. In a study by Zhang et al. [19], BIM has brought great advantages to project delivery and performance although it has also increased project complexity. Therefore, the legal aspects within BIM contexts should be established in design phase in both workflow and information management.

If BIM is used, it is important that this is outlined in any construction contract with the aim to clarify rights and obligations between contracting parties and, moreover, to avoid future conflicts between the design team and the construction company in construction phase. Therefore, the benefits of using BIM may be limited by legal issues and problems, final intellectual property of the digital model, and the obligation for it to contain the necessary information to execute a project. The legal aspects of using BIM have led to the emergence of the professional "BIM manager," who is responsible for coordination among different BIM users, as well as ensuring data security. This new role within a project design company is essential for all obtained information throughout the development of a complete project to be centralized [20].

Another aspect that should be considered is establishing and controlling the level of information to be included in a model, i.e., to define a level of development (LOD), for each stage of the project, according to the specific characteristics detailed in the contract with the aim of assisting project management [21]. It can also be included in the contract who will provide the maintenance service for the as-built model (BIM 7D). The consequences of sharing a digital model with the contractor can have a positive impact on communication between its design and execution. It is also important that contracts for BIM projects define boundaries for each member of the design team, so as to avoid future conflict situations. To sum up and according to a study by Chong et al. [22], the legal minimum aspects that could be used as contractual provisions associated with BIM implementation include the roles and relationships between agents (designer–contractors and client), the digital information manager, and ownership of the digital model.

Finally, some authors are currently presenting the advantages of making smart contracts in BIM. They highlight the integration of BIM and the blockchain process as a method for controlling project information [23]. In this line, the use of smart contracts based on BIM and blockchain is highlighted for contractual practices that automate payment management between developers and contractors [24, 25]. These practices are far from being implemented in Spain due to the uncommon nature of this modality.

2.2. BIM Use Effectiveness. Literature shows that using BIM in design phase brings benefits such as competitive advantages in the market, increased collaboration and improved construction safety performance [26], support for sustainable construction [27], controlled project information [28], improved 3D project visualization [29], improved project quality [30], and improved design understanding and construction monitoring [31]. In addition, designers and construction managers can use BIM, for example, to complete tasks in innovative ways to address challenges in complex construction projects, contributing to the further development and professionalization of the construction industry in general [32, 33]. On the other hand, information processing capability in BIM is referred to as "dimension" [34]. Three-dimensional construction is referred to as 3D; it incorporates the physical properties of materials in the model. 4D BIM (task planning) incorporates time and can perform virtual construction simulations. 5D BIM (cost studies) incorporates price [35, 36]. Sustainability analysis is 6D BIM dimension, enabling energy simulation in projects [37]. 7D BIM is dedicated to the operations phase in order to have the necessary documentation to manage maintenance [38, 39]. 8D BIM is dedicated to occupational risk prevention in the design phase [40]. Currently, a number of BIM software manufacturers have incorporated 9D BIM (lean construction) and 10D BIM (industrialized construction).

As it can be deduced, BIM technology allows project information to be integrated and, therefore, be used for different purposes, the BIM model being a communication mechanism between contracting parties and the model responding to conditions outlined in the contract. Nonetheless, "effectiveness" can be understood as the degree to which something is successful in producing a desired result. Conclusively, a way of defining BIM use effectiveness can be defined as "the ability of a project team to successfully make use of BIM dimensions in order to meet set goals within a contract."

2.3. Project Performance in the Context of BIM. For decades, many researchers have placed a strong emphasis on the importance of adopting effective measures to improve current project performance in the construction industry [41, 42]. Research models where project performance is explained are found in the literature that focuses on the construction phase under unit price contracts [43]. Nowadays, project management is becoming increasingly important in design phase; however, there are not many studies on the evaluation of project performance when designed with BIM technology [44], although the literature acknowledges that designing with BIM technology brings significant improvements in project outcomes [45]. Decades ago, some authors had already demonstrated the integration of BIM in construction projects bringing benefits both in terms of cost reduction and improved communication and information exchange between the various stakeholders throughout a project life cycle [46]. Zhang et al. [19] explained that BIM use effectiveness can directly improve project performance as long as there is adequate management of the roles played by stakeholders.

On the other hand, according to a study by Cha and Kim [47], project characteristics directly affect the performance of a project depending on the type of project, so there is no standard for measuring project performance in the construction industry. Project performance does not have a unified definition in the literature [48] because it depends on the phase of the project where it is evaluated (design, construction, or

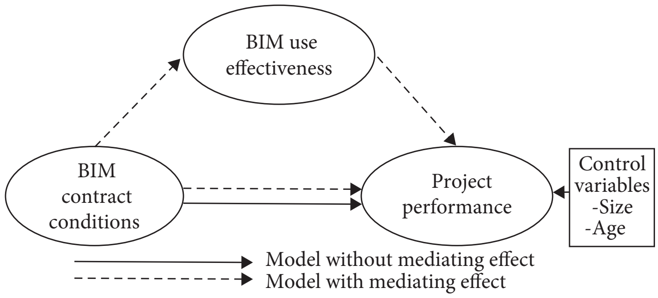

Figure 1: The research model.

operation). In traditional engineering or construction projects, many factors can affect project success such as schedule, cost, and quality [49]. Cruz Villazón et al. [50] stressed that project safety and benefit should be incorporated to evaluate and measure project success. Shenhar et al. [51] suggested that project success includes short- and long-term project objectives, such as schedule control, satisfaction of customer interests and needs, commercial value and market share success, and technological innovation. It is recommend, including stakeholder satisfaction and communication, to determine project success [52].

3. Research Gap and Hypothesis

Numerous studies claim that companies that use BIM in projects create value and generate benefits for the contracting parties [53]. This is why, in recent years, a growing interest in BIM is surfacing. In this sense, the possible better performance of the project has become one of the objectives with more weight in management decision making. In addition, the inclusion of contractual clauses is being promoted [45]. However, although there are contributions in the literature stating that contracts affect project results/performance [1], the cause–effect relationship between both aspects is still not very clear. Also, it is of interest to try to analyze the strategic role that the effectiveness of BIM use has in such relationship, since the effectiveness of BIM use is a variable present in the team engaged in designing projects in the BIM environment, becoming a key factor for the contractual objectives [19]. Based on these premises, this paper analyzes the mediating effect of the effectiveness of BIM use on the relationship between contractual conditions and project performance. On this basis, the research model is shown in Figure 1 and, therefore, the following research hypothesis is formulated:

H1: In the design phase, BIM use effectiveness is a mediating variable in the relationship between contract conditions and project performance.

3.1. Relevance of the Research. Contract management in the construction sector has become a regulating element between traditional processes and the current needs demanded by technological change. The research conducted reviews the scientific contributions in contract management [13, 14, 17, 22], the effectiveness of using BIM [3, 27, 35, 36, 54], and the performance of projects [55–58] in the design phase of construction. A lack of collaboration (human factors) in the application of BIM was detected. This research reaffirms the importance of regulating the ability to use BIM technology to predict project performance.

4. Research Method

Architecture, engineering, and construction engineering (AEC) companies in Spain where BIM technology is being used for projects have been the target population of this research. A sample of 92 firms in the architecture/engineering design industry who were in the design phase of the facility life cycle were surveyed in order to collect data. The survey, in which corporate data and variables questions had been included, was distributed with the help of Spanish associations of architecture and engineering professionals. It was also reviewed by academics and conducted in five different companies. Field work began in November 2019 and ended in April 2020. A total of 106 surveys were completed and 92 of them were validated.

4.1. Data Analysis. For predictive purposes, the PLS-SEM technique was used to assess how strong the link between variables can be in this study; it must be taken into account that research studies on management issues [55] tend to use the aforementioned method, thereby being the most appropriate one due to the presence of unobserved variables (constructs that cannot be directly measured) in the model. In the literature, researchers have used the PLS technique during the last decades to explain or predict events or management problems in the construction industry [56, 57, 59–61].

In order to explain or predict managerial issues, PLS-SEM has been used over the past decades in literature. It also seems to be the most relevant considering (1) small sample size, conceptual model conduct, and nonnormal variables [55]; (2) lack of thorough subject knowledge [62]; (3) formative indicators in measurement models [62]; and (4) PLS-SEM usefulness in mediation analysis [63]. To perform the structural model and assessment, SmartPLS 3.0 was used.

4.2. Sampling. Due to the predictive nature of the model and samples (under 250), it can be understood that the number of samples were dependent on the amount of links found between variables [64, 65]. A minimum of 59 samples were suggested for every three links, and because there were an existing number of 92 samples available on the database, a medium effect size ($f2 = 0.15$), 80% power, and 0.05 α level were caused. Using a 95% confidence interval and a 10.21% error rate, the analysis was conducted within construction companies whose projects implement BIM.

Table 1 shows descriptive data of such firms, of which 68.1% were microenterprises, 63.4% were 3 years into using BIM, and 40.4% were using BIM in over 80% of their projects. Concerning projects, around 50% were building related, 30% facility engineering oriented, and 20% focused on architecture and civil engineering.

4.3. Measurement of Variables and Indicators. In order for literature to be reviewed, a variety of constructs were to be measured, and, therefore, items had to be created. So, as to capture managers' viewpoints on model variables: BIM contract conditions (BCC), BIM use effectiveness (BUE), and

Table 1: The descriptive statistics of the sampled companies.

Type of BIM company	Percentage (%)
Architecture	48.9
Engineering facilities	30.4
Civil engineering and architecture	20.7
Company size	Percentage (%)
Micro companies (under 10)	68.1
Small companies (11–50)	22.3
Medium companies (51–250)	8.5
Big companies (over 250)	1.1
Annual turnover € million (Euros)	Percentage (%)
Under 2	80.4
2–10	15.2
10–50	3.9
Over 50	0.5
Number of years using BIM	Percentage (%)
Under 1	9.7
1–2	16.1
2–3	10.8
Over 3	63.4
Project fulfillment with BIM tools	Percentage (%)
Under 20%	8.5
20–40%	12.8
40–60%	21.3
60–80%	17
Over 80%	40.4

project performance (PP), indicators were categorized into measurement scales. As shown in Table 2, by adapting researchers' validated contributions to literature, questions related to model variables were able to be designed. A five-item Likert scale (1 = completely disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = completely agree) was essential in order to develop indicators, apart from BBC1, BUC6 dichotomous, and BUE7 categorical.

Finally, it should be noted that two control variables "firm size" measured through the number of employees [66] and "age" measured through the number of years the firm has been operating since its foundation [58] have been introduced on the dependent variable (project performance). This is intended to neutralize the effects of firm size and age on the dependent variable. All the variables in the model (BCC, BUE, PP) were conceptualized as formative indicators in the measurement model, as it is appropriate when the indicators directly help to create the construct.

In the measurement model, it can be seen that all variables (BCC, BUE, PP) were found to be formative indicators owing to their relevance when helping create the construct itself. Measurement model tests vary depending on whether the causal nature of the indicators derive from the construct or not, it being formative [58]. A construct in which formative indicators are present entails each of them independently capturing dissimilar aspects of variables [67], thus exempting formative indicators from being highly correlated. In the case of formative indicators, reliability and validity are not applicable, although the possibility of multicollinearity must be assessed [68] where the possible scenario of indicators measuring similar aspects can be found, for which the variance inflation factor (VIF) test was used. Some authors recommend its value to be under 3.3, lacking multicollinearity [58]. Indicator contributions to measured concepts with regard to weight and statistical value must also be taken into account, alongside nomological indicators. Indicators that had a VIF greater than 3.3 (BUE3, BUE4) and their weights were close to zero and had no significance (BUE5, BUE6) were eliminated. Control variables (company age and size) can no longer be found due to their lack of statistical significance.

5. Results

5.1. Measurement Model. Measurement model results are shown in Table 3. It is observed that in Spain, the contracts that request BIM are not yet collaborative and the rights, obligations, and responsibilities of the designer are not yet clear in the contractual conditions, since the BCC3 and BCC4 indicators are not significant for the variable they represent BIM conditions of the contract. In the same way, these results revealed what is recently being learnt in BIM technology is not being updated in all phases of the facility life cycle that the new knowledge acquired in BIM technology is not applied to all phases of the life cycle of the building or infrastructure (design, construction, and operation), since the BUE1 indicator does not turn out to be significant for the variable, which represents BIM use effectiveness.

From a design company perspective, according to the results obtained from the measurement model, BIM implementation in projects does not reduce the drafting cost, does not reduce the duration of the drafting phase of the project, and does not improve any form of collaboration nor communication within any phase of a facility life cycle, fundamentally between owners and employers. The above is due to the fact that the PP2, PP3, and PP5 indicators are not significant for the variable they represent project performance.

5.2. Structural Model. Not until the measurement model had been analyzed were the links among variables within the structural model tested. This can be done following two steps: formerly, removing the mediating variable from the model for it to be analyzed (direct effect) and latterly adding it to again perform analysis. The bootstrap method was used (with 5,000 subsamples) to found the level of statistical signification.

The demonstrable significance of mediation hypothesis, which indicated a (+) sign, was used for a one-tailed t-test, in which t-values of each path coefficient (sign, value, and significance) supported the hypothesis. Figure 2 shows a summary of structural analysis results for the direct effects model (step 1), and the full effects model (step 2) is shown in Figure 3, where the aforementioned explained variance (R^2), standardized path coefficients, and statistical significance have been added in brackets.

Table 2: Variables (constructs)/indicators.

BIM contract conditions (BCC) Source based on [13, 14, 17, 22]	
BCC1	In the last year, the use of BIM in contracts has become mandatory
BCC2	In the last 3 years, contracts requesting the use of BIM require its use in all phases of the life cycle of the building or infrastructure (design, construction, and operation)
BCC3	In the last 3 years, the contracts requesting the use of BIM are not traditional (project contracting on one hand and construction on the other hand) but collaborative (project and construction concession or similar)
BCC4	In the last 3 years, the contracts requesting the use of BIM include the rights, obligations, and responsibilities of the designer
BIM use effectiveness (BUE) Source based on [3, 27, 35, 36, 54]	
BUE1	The new knowledge acquired in BIM technology is applied to all phases of the building or infrastructure life cycle (design, construction, and operation)
BUE2	The project team is familiar with the functionality of BIM applications with respect to design and 3D modeling
BUE3	The project team is familiar with the functionality of BIM 4D applications for time planning
BUE4	The project team is familiar with the functionality of BIM 5D for assessing the cost
BUE5	The project team is familiar with the functionality of BIM 6D applications for energy efficiency and sustainability (energy savings)
BUE6	Tools are used to detect interferences between services and facilities of the project
BUE7	What is the approximate percentage of project realization with BIM tools?
Project performance (PP) Source based on [55–58]	
PP1	How many years have you been using BIM technology in the realization of projects?
PP2	From the perspective of the design company, the use of BIM in the project reduces the cost of the drafting phase of the project
PP3	From the perspective of the design company, the use of BIM in the project reduces the duration of the drafting phase of the project
PP4	From the perspective of the design company, the use of BIM in the project improves the final design of the construction
PP5	From the perspective of the design company, the use of BIM in the project improves communication and collaboration with the other agents involved in the life cycle of the infrastructure (mainly the developer and contractor)

Table 3: Results of the measurement model.

BIM contract conditions	Weight	*T*-valor	VIF
BCC1	0.849^{***}	3.430	1.792
BCC2	0.361^{*}	1.656	1.862
BCC3	0.010^{ns}	0.145	2.128
BCC4	-0.196^{ns}	0.751	1.976
BIM use effectiveness	Weight	*T*-valor	VIF
BUE1	0.281^{ns}	1.497	1.202
BUE2	0.296^{*}	2.098	1.452
BUE7	0.658^{**}	2.777	1.464
Project performance	Weight	*T*-valor	VIF
PP1	0.579^{**}	2.667	1.103
PP2	0.182^{ns}	1.638	1.177
PP3	-0.079^{ns}	0.472	1.093
PP4	0.415^{*}	2.121	1.783
PP5	0.224^{ns}	1.536	1.694

Note: $^{***}p<0.001$, $^{**}p<0.01$, and $^{*}p<0.05$, NS, not significant (based on $t(4999)$, one-tailed test). $t(0.05, 4999) = 1.645$; $t(0.01, 4{,}999) = 2.327$; $t(0.001, 4{,}999) = 3.092$.

Ultimately, strength in the mediation model, as shown in Figure 3, must also be analyzed, which is calculated through VAF, as suggested by Hair et al. [69]. Table 4 shows that 64.66% of the effect BIM has on contract conditions within project performance is understood through BIM use effectiveness, meaning VAF value goes from 20% to 80%, demonstrating that BIM use effectiveness partially acts as a mediator in BIM contract conditions—project performance relationships, supporting H1.

6. Discussion

Regarding the BIM contract conditions, as observed in the measurement model, the use of BIM in contracts is mandatory "BCC1" and contracts requesting BIM require its use in each phase of a project life cycle "BCC2" (design, construction, and operation). These results are in line with the remarks made by Chong et al. [22]. In Spain, the contracts requesting BIM are still not collaborative "BCC3" and the

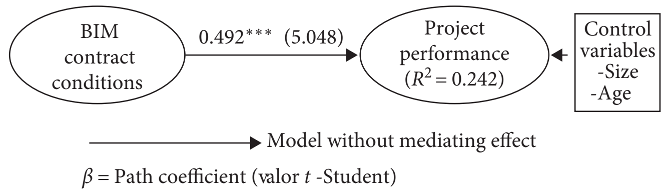

FIGURE 2: Model of direct influence of BIM contract conditions on project performance in design phase (step 1). *Note*: $^{***}p < 0.001$.

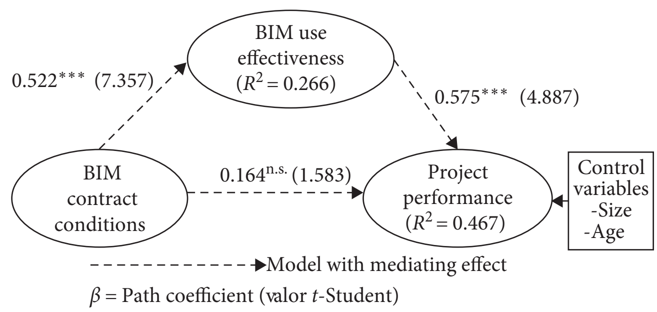

FIGURE 3: Model of the mediating effect of BIM use effectiveness on the relationship between BIM contract conditions on project performance in design phase (step 2). *Note*: $^{***}p < 0.001$.

TABLE 4: Hypothesis testing and mediation analysis.

Indirect effect	Effect of BCC on BUE = 0.522 Total indirect effect = 0.522 × 0.575 = 0.30015	Effect of BUE on PP = 0.575
Total effect	Indirect effect + direct effect (0.30015 + 0.164) = 0.46415	VAF = 64.66% VAF = total indirect effect/total effect × 100
BBC → BUE: VIF = 1.0000	$p = 0.00000$	Percentile (5%/95% confidence interval) = (0.33554/0.60181)
BBC → PP: VIF = 1.37442	$p = 0.05990$	Percentile (5%/95% confidence interval) = (−0.03975/0.29640)
BUE → PP: VIF = 1.37442	$p = 0.0000$	Percentile (5%/95% confidence interval) = (0.36352/0.74442)

rights, obligations, and responsibilities of the designer are still not clear in the contractual conditions "BBC4," perhaps, because there is no established BIM protocol in the contracting [70, 71]. Regarding BIM use effectiveness in Spain, we can observe that BIM is not really used in each phase of a facility life cycle "BUE1" and only 3D design is being worked "BUE2." Perhaps, this is due to a lack of knowledge and/or experience within the BIM team [72] in planning (4D BIM), cost evaluation (5D BIM), and sustainability (6D BIM) at the time of the fieldwork. However, the higher the percentage of BIM implementation within projects, the better-defined BIM use effectiveness in the design phase "BUE7." Regarding project performance in the measurement model, results show that the number of years using BIM influences project performance "PP1", and it is recognized that the BIM use effectiveness improves the final construction design "PP4" by improving construction efficiency and minimizing design errors according to a study by Dossick and Neff [31] and Gamil and Rahman [72]. It is surprising that in Spain, benefits of using BIM such as decreasing project cost [28], decreasing project duration [27], and improving communication between agents [26] do not impact on project performance in the design phase. Perhaps, the above can be explained as a result of a lack of experience using BIM and BIM training efforts among the design team members and the lack of BIM training on the part of the contracting party as barriers explained in the literature. With respect to the structural model, the hypothesized mediating effect BIM use effectiveness on the relationship between BIM contract conditions and project performance has been analyzed. This effect is found to be partial: it improves the explanation of project performance in design firms in the AEC sector and fuller explanation of the direct effect model. This is because technological advances in projects should be regulated in construction contracts [45]. Currently and according to ISO 19650-3 published in July 2021, it is the contracting party who must evaluate all proposals received and hire one or more candidates depending on the scope of the project. Subsequently, each main contracting party must confirm its BIM execution plan (BEP) and establish a responsibility matrix and a delivery plan. In respect to the current efforts in the implementation of BIM, researchers are claiming that the little information about contractual practices can affect BIM implementation and subsequent project performance [1]. In this regard, Nilchian et al. [2] and Rahman and Sainati [73] detected that existing conventional construction contracts are not adapted to the collaborative approach of BIM, leading to potential contractual disputes. Therefore, the literature works to identify suitable contract provisions when BIM is used on the project, establishing a legal framework for contract types and BIM protocols [1, 2, 13]. There is a general consensus that adequate contractual conditions setting out the obligations, responsibilities, and liabilities of the contracting parties are essential for the successful implementation of BIM [74]. The contracts do not promote collaboration and, therefore, may not be suitable for BIM projects, influencing project performance [75]. Manderson and Jefferies [76] confirmed the need to adopt a collaborative contractual structure with equitable risk and reward mechanisms, the recognition of the model as a contractual document and the need to standardize communication and information exchange. Mahdian et al. [77] proposed a comprehensive contract form that includes all clauses and provisions necessary to address all these legal risks of implementing BIM. To conclude, it is clear that many authors have made efforts to resolve and reduce disputes between the contracting parties; from a legal point of view and in conjunction with our study, it can be affirmed with our results that contract considerations determine the effectiveness of the use of BIM [22]. Furthermore, our contributions are in line with the impacts of the contractual aspects within the BIM functionality with the contract procurement methods [78]. Other authors propose to establish policies to improve effective communication between project team members in BIM design because improving trust between the agents involved in the project generates the overall satisfaction of all by decreasing future conflicts [79].

7. Conclusions

BIM contract conditions and its effective use in project performance attract both academic and professional interest. This interest is also observed in public administrations as the highest contracting body in public projects. The outcomes of this study reveal that project performance in the design phase in a BIM context depends on the conditions imposed in the contract. In addition, BIM use effectiveness acts as a mediator in the link between contract conditions and project performance. Technological advances in projects are, therefore, changing construction contracts. This indicates that the impact of the legal provisions and terms of BIM are so important on the contract that the construction industry must have professionals capable of delivering both regulatory and contractual compliance of the project according to the specifications and conditions established between the parties. According to the findings of this research, it can be demonstrated that contracts in Spain requesting BIM are still not collaborative. However, both architects and engineers should specialize in BIM methodology where the working environments are supposed to be much more collaborative. Regarding the contractual conditions, results indicate that the obligations and responsibilities of the designer are not yet clear. As practical recommendations, it would also be important to call on the promoter administrations (contracting party) to try to specify the objectives of BIM, drawing up the BIM information requirements (prescriptive specifications) to be demanded in their project. In addition, it must be reviewed and approved a BEP, so that all steps in the construction phase are clear, and there are no conflicts. On the other hand, the project design offices (contracted party) must comply with the BIM requirements demanded in the contract conditions. Besides, the BIM design team should be aware of their responsibilities and roles, delivering the project documentation with the conditions required in the contract. This will require professionals capable of BIM construction management. Contractual and legal changes are required on several fronts to facilitate the use of BIM in projects. For example, the digital exchange of information should be clear in the contract, as well as the responsibility and risks between the contracting parties for a more collaborative effort. Further practical recommendations, the AECO industry must embrace the cultural change necessary to carry out the digital transformation that should improve the productivity and competitiveness of the BIM project with legal practices throughout the supply chain. In summary, the construction contracts that include virtual and physical design and construction in the BIM environment procedures must be established, so that there are no disputes between the different agents involved; therefore, the importance of establishing legal protocols in the handling of technology and information management must include standards for the processes that support the legal obligations and responsibilities that are created when using the BIM working method.

This study has managerial contributions; since due to the use of technology on one hand and the human factor on the other hand, contractual practices become a fundamental tool to avoid possible conflicts and disputes. If the contract does not regulate both aspects adequately, the expected benefits of a BIM project will be diminished. In this research, it is demonstrated that the effectiveness of the use of BIM has a mediating variable effect on the relationship between contract conditions and project performance. Therefore, construction managers, developers, and BIM consultants should analyze contracts well because of their influence on project performance through the regulation of the use of technology and the management of contractual information. This study is developed in Spanish companies; so, the limitations of this research are that the results are not generalizable to other countries due to cultural barriers that exist between different countries. In future lines of research, this model could be applied in the construction phase. On the other hand, this research can be extended to other countries in AEC companies in the design phase and later in AEC companies in the construction phase, comparing the results obtained.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

The authors thank to the following professional associations for their cooperation: COAS, COIICV, COIIM, COIIAR, COIIEX, COPITI Andalusia, and COPITI Extremadura.

References

[1] A. Celoza, F. Leite, and D. P. de Oliveira, "Impact of BIM-related contract factors on project performance," *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, vol. 13, no. 3, Article ID 04521011, 2021.

[2] S. Nilchian, J. Majrouhi Sardroud, M. Darabpour, and S. Tavousi Tafreshi, "Features and conditions of building information modeling contracts," *Buildings*, vol. 12, no. 11, Article ID 1839, 2022.

[3] C. Boton and D. Forgues, "Practices and processes in bim projects: an exploratory case study," *Advances in Civil Engineering*, vol. 2018, Article ID 7259659, 12 pages, 2018.

[4] T. Vilutiene, D. Kalibatiene, M. R. Hosseini, E. Pellicer, and E. K. Zavadskas, "Building information modeling (BIM) for structural engineering: a bibliometric analysis of the literature," *Advances in Civil Engineering*, vol. 2019, Article ID 5290690, 19 pages, 2019.

[5] P. Gholizadeh, B. Esmaeili, and P. Goodrum, "Diffusion of building information modeling functions in the construction industry," *Journal of Management in Engineering*, vol. 34, no. 2, Article ID 4017060, 2018.

[6] A. Wahab and J. Wang, "Factors-driven comparison between BIM-based and traditional 2D quantity takeoff in construction cost estimation," *Engineering, Construction and Architectural Management*, vol. 29, no. 2, pp. 702–715, 2021.

[7] A. Alashwal, H. Abdul-Rahman, and A. Beksin, "Knowledge sharing in a fragmented construction industry: on the hindsight," *Scientific Research and Essays*, vol. 6, pp. 1530–1536, 2011.

[8] I. Kim and J. I. Kim, "Special issue on BIM and its integration with emerging technologies," *Applied Sciences*, vol. 12, no. 11, Article ID 5368, 2022.

[9] K. Ullah, I. Lill, and E. Witt, "An overview of BIM adoption in the construction industry: benefits and barriers," in *10th Nordic Conference on Construction Economics and Organization; Emerald Reach Proceedings Series*, vol. 2, pp. 297–303, Emerald Publishing Limited, Bingley, UK, 2019.

[10] A. Marefat, H. Toosi, and R. Mahmoudi Hasankhanlo, "A BIM approach for construction safety: applications barriers and solutions," *Engineering, Construction and Architectural Management*, vol. 26, pp. 1855–1877, 2019.

[11] M. R. Hosseini, I. Martek, E. Papadonikolaki, M. Sheikhkhoshkar, S. Banihashemi, and M. Arashpour, "Viability of the BIM manager enduring as a distinct role: association rule mining of job advertisements," *Journal of Construction Engineering and Management*, vol. 144, no. 9, Article ID 04018085, 2018.

[12] P. Piroozfar, E. R. P. Farr, A. H. M. Zadeh, S. Timoteo Inacio, S. Kilgallon, and R. Jin, "Facilitating building information modelling (BIM) using integrated project Delivery (IPD): a UK perspective," *Journal of Building Engineering*, vol. 26, Article ID 100907, 2019.

[13] M. Ragab and M. Marzouk, "BIM adoption in construction contracts: content analysis approach," *Journal of Construction Engineering and Management*, vol. 147, Article ID 04021094, 2021.

[14] R. Sacks, C. M. Eastman, P. Teicholz, and G. Lee, *BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers*, Wiley & Sons, Inc, 3rd edition, 2018.

[15] ISO, "Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)—Information management using building information modelling," 2018.

[16] E. Pellicer, M. A. Sanz, B. Esmaeili, and K. R. Molenaar, "Exploration of team integration in Spanish multi-family residential building construction," *Journal of Management in Engineering*, vol. 32, no. 5, Article ID 05016012, 2016.

[17] R. Ren and J. Zhang, "A new framework to address BIM interoperability in the AEC domain from technical and process dimensions," *Advances in Civil Engineering*, vol. 2021, Article ID 8824613, 17 pages, 2021.

[18] J. K. Larsen, G. Q. Shen, S. M. Lindhard, and T. D. Brunoe, "Factors affecting schedule delay, cost overrun, and quality level in public construction projects," *Journal of Management in Engineering*, vol. 32, no. 1, Article ID 04015032, 2016.

[19] H. M. Zhang, H.-Y. Chong, Y. Zeng, and W. Zhang, "The effective mediating role of stakeholder management in the relationship between BIM implementation and project performance," *Engineering, Construction and Architectural Management*, 2022.

[20] R. A. Rahman, S. Alsafouri, P. Tang, and S. K. Ayer, "Comparing building information modeling skills of project managers and bim managers based on social media analysis," *Procedia Engineering*, vol. 145, pp. 812–819, 2016.

[21] M. Nilsen and R. A. Bohne, "Evaluation of BIM based LCA in early design phase (low LOD) of buildings," in *IOP Conference Series: Earth and Environmental Science*, May 2022.

[22] H.-Y. Chong, S.-L. Fan, M. Sutrisna, S.-H. Hsieh, and C.-M. Tsai, "Preliminary contractual framework for BIM-enabled projects," *Journal of Construction Engineering and Management*, vol. 143, no. 7, Article ID 04017025, 2017.

[23] A. Celoza, D. P. de Oliveira, and F. Leite, "Qualitative analysis of the impact of contracts on information management in AEC projects," *Journal of Construction Engineering and Management*, vol. 149, no. 3, 2023.

[24] K. Sigalov and M. König, "BIMcontracts—sichere digitale Transaktionen in der Baubranche," *Bautechnik*, vol. 100, no. 4, pp. 174–179, 2023.

[25] A. Shojaei, I. Flood, H. I. Moud, M. Hatami, and X. Zhang, "An Implementation of Smart Contracts by Integrating BIM and Blockchain," in *Proceedings of the Future Technologies Conference (FTC) 2019. FTC 2019. Advances in Intelligent Systems and Computing*, K. Arai, R. Bhatia, and S. Kapoor, Eds., vol. 1070, Springer, Cham, 2020.

[26] A. Ghaffarianhoseini, J. Tookey, A. Ghaffarianhoseini et al., "Building information modelling (BIM) uptake: clear benefits, understanding its implementation, risks and challenges," *Renewable and Sustainable Energy Review*, vol. 75, pp. 1046–1053, 2017.

[27] Z. Alwan, P. Jones, and P. Holgate, "Strategic sustainable development in the UK construction industry, through the framework for strategic sustainable development, using building information modelling," *Journal of Cleaner Production*, vol. 140, pp. 349–358, 2017.

[28] J. Rogers, H.-Y. Chong, and C. Preece, "Adoption of building information modelling technology (BIM)," *Engineering, Construction and Architectural Management*, vol. 22, no. 4, pp. 424–445, 2015.

[29] A. Elmualim and J. Gilder, "BIM: innovation in design management, influence and challenges of implementation," *Architectural Engineering and Design Management*, vol. 10, no. 3-4, pp. 183–199, 2014.

[30] A. Aibinu and S. Venkatesh, "Status of BIM adoption and the BIM experience of cost consultants in Australia," *Journal of Professional Issues in Engineering Education and Practice*, vol. 140, no. 3, Article ID 04013021, 2014.

[31] C. S. Dossick and G. Neff, "Organizational divisions in BIM-enabled commercial construction," *Journal of Construction Engineering Management. ASCE*, vol. 136, no. 4, pp. 459–467, 2010.

[32] E. Hyarat, T. Hyarat, and M. Al Kuisi, "Barriers to the implementation of building information modeling among Jordanian AEC companies," *Buildings*, vol. 12, no. 2, Article ID 150, 2022.

[33] P. Suermann and R. Issa, "Evaluating industry perceptions of building information modelling (BIM) impact on construction," *Journal of Information Technology in Construction (ITcon)*, vol. 14, pp. 574–594, 2009.

[34] A. Koutamanis, "Dimensionality in BIM: why BIM cannot have more than four dimensions?" *Automation in Construction*, vol. 114, Article ID 103153, 2020.

[35] M. Mayouf, M. Gerges, and S. Cox, "5D BIM: an investigation into the integration of quantity surveyors within the BIM process," *Journal of Engineering Design and Technology*, vol. 17, pp. 537–553, 2019.

[36] P. Mesároš, J. Smetanková, and T. Mandičák, "The fifth dimension of BIM-implementation survey," in *Proceedings of the IOP Conference Series: Earth and Environmental Science 222, Brno, Czech Republic, 17-19 October*, February 2022, https://iopscience.iop.org/article/10.1088/1755-1315/222/1/012003, 2018.

[37] R. Charef, H. Alaka, and S. Emmitt, "Beyond the third dimension of BIM: a systematic review of literature and assessment of professional views," *Journal of Building Engineering*, vol. 19, pp. 242–257, 2018.

[38] G. Cantisani, J. D. Correa Panesso, G. Del Serrone, P. Di Mascio, G. G. Loprencipe, and L. Moretti, "Re-design of a road node with 7D BIM: geometrical, environmental and micro-simulation approaches to implement a benefit-cost analysis between alternatives," *Automation in Construction*, vol. 135, Article ID 104133, 2022.

[39] A. Oti, E. Kurul, F. Cheung, and J. Tah, "The utilization of BMS in BIM for facility management," in *Proceedings of the CIB World Building Congress, Tampere, Finland, 30 May-3 June*, Tampere, Finland, 2016.

[40] I. Kamardeen, "8D BIM modelling tool for accident prevention through design," in *Proceedings of the 26th Annual Association of Researchers in Construction Management (ARCOM) Conference, Leeds, UK, 6-8 September 2010*, pp. 281–289, 2010.

[41] S. J. Eagan, "Rethinking construction," in *Construction Task Force, UK*, 1998.

[42] S. M. Latham, *Constructing the team. Final Report of the Government /Industry Review of Procurement and Contractual Arrangements in the UK Construction Industry*, HMSO Publications Centre, London, UK, 1994.

[43] H. Leon, H. Osman, M. Georgy, and M. Elsaid, "System dynamics approach for forecasting performance of construction projects," *Journal of Management in Engineering*, vol. 34, no. 1, Article ID 04017049, 2018.

[44] J. Zhu, "Research on performance evaluation of construction project management," in *IOP Conference Series: Earth and Environmental Science*, vol. 330, Article ID 022036, June 2022.

[45] M. A. Ragab and M. Marzouk, "BIM adoption in construction contracts: content analysis approach," *Journal of Construction Engineering and Management*, vol. 147, no. 8, Article ID 04021094, 2021.

[46] B. Succar, "Building information modelling framework: a research and delivery foundation for industry stakeholders," *Automation in construction*, vol. 18, no. 3, pp. 357–375, 2009.

[47] H. Cha and K. H. Kim, "Measuring project performance in consideration of optimal best management practices for building construction in South Korea," *KSCE Journal of Civil Engineering*, vol. 22, no. 8, pp. 1614–1625, 2018.

[48] V. S. Parsons, "Project performance: how to assess the early stages," *Engineering Management Journal*, vol. 18, no. 4, pp. 11–15, 2016.

[49] K. E. Papke-Shields, C. Beise, and J. Quan, "Do project managers practice what they preach, and does it matter to project success?" *International Journal of Project Management*, vol. 28, no. 7, pp. 650–662, 2010.

[50] C. Cruz Villazón, L. Sastoque Pinilla, J. R. Otegi Olaso, N. Toledo Gandarias, and N. de Lopez Lacalle, "Identification of key performance indicators in project-based organisations through the lean approach," *Sustainability*, vol. 12, no. 15, Article ID 5977, 2020.

[51] A. Shenhar, A. Tishler, D. Dvir, S. Lipovetsky, and T. Lechler, "Refining the search for project success factors: a multivariate, typological approach," *R&D Management*, vol. 32, no. 2, pp. 111–126, 2002.

[52] J. S. Chou and N. T. Ngo, "Identifying critical project management techniques and skills for construction professionals to achieving project success," in *IEEE International Conference on Industrial Engineering and Engineering Management*, pp. 1204–1208, IEEE, 2015.

[53] V. Malla, M. Jagannathan, and V. S. Kumar Delhi, "Identification of BIM dimension-specific contract clauses in EPC turnkey projects," *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, vol. 14, no. 1, pp. 1–13, 2021.

[54] Accasoftware, "Las dimensiones del BIM: 3D, 4D, 5D, 6D, 7D, 8D, 9D, 10D," June 2022, https://biblus.accasoftware.com/es/las-dimensiones-del-bim/.

[55] K. K.-K. Wong, "Partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS," *Marketing Bulletin*, vol. 24, no. 1, pp. 1–32, 2013.

[56] S. Durdyev, S. Ismail, and N. Kandymov, "Structural equation model of the factors affecting construction labor productivity," *Journal of Construction Engineering and Management*, vol. 144, Article ID 04018007, 2018.

[57] M. Gunduz, M. T. Birgonul, and M. Ozdemir, "Fuzzy structural equation model to assess construction site safety performance," *Journal of Construction Engineering and Management*, vol. 143, Article ID 04016112, 2017.

[58] X. Luo, L. Zhou, and S. Liu, "Entrepreneurial firms in the context of china's transition economy: an integrative framework and empirical examination," *Journal of Business Research*, vol. 55, pp. 277–284, 2005.

[59] H. M. Zhang, H.-Y. Chong, Y. Zeng, and W. Zhang, "The effective mediating role of stakeholder management in the relationship between BIM implementation and project performance," *Engineering, Construction and Architectural Management*, vol. 30, no. 6, pp. 2503–2522, 2022.

[60] A. F. Kineber, I. Othman, A. E. Oke, N. Chileshe, and T. Zayed, "Value management implementation barriers for sustainable building: a bibliometric analysis and partial least square structural equation modelling," *Construction Innovation*, 2021.

[61] A. Mohammed Alashwal and H. Abdul-Rahman, “Aspects of project learning in construction: a socio-technical model,” *Construction Innovation*, vol. 14, no. 2, pp. 229–244, 2014.
[62] M. Martinez and E. Moreno, “Application of the PLS-SEM technique in knowledge management: a practical technical approach,” *RIDE Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, vol. 8, no. 16, pp. 130–164, 2018.
[63] A. Diamantopoulos and H. M. Winklhofer, “Index construction with formative indicators: an alternative to scale development,” *Journal of Marketing Research*, vol. 38, no. 2, pp. 269–277, 2001.
[64] C. Nitzl, J. L. Roldan, and G. Cepeda, “Mediation analysis in partial least squares path modeling: helping researchers discuss more sophisticated models,” *Industrial Management & Data Systems*, vol. 116, no. 9, pp. 1849–1864, 2016.
[65] W. Reinartz, M. Haenlein, and J. Henseler, “An empirical comparison of the efficacy of covariance-based and variance-based SEM,” *International Journal of Research in Marketing*, vol. 26, pp. 332–344, 2009.
[66] C. Zott and R. Amit, “The fit between product market strategy and business model. Implications for firm performance,” *Strategy Management Journal*, vol. 29, no. 1, pp. 1–26, 2008.
[67] S. Petter, D. Straub, and A. Rai, “Specifying formative constructs in information systems research,” *MIS Quarterly*, vol. 31, no. 4, pp. 623–656, 2007.
[68] N. P. Podsakoff, W. Shen, and P. M. Podsakoff, “The role of formative measurement models in strategic management research: review, critique, and implications for future research,” *Research Methodology in Strategy and Management*, vol. 3, pp. 197–252, 2006.
[69] J. F. Hair Jr, M. Sarstedt, L. Hopkins, and V. G. Kuppelwieser, “Partial least squares structural equation modeling (PLS-SEM): an emerging tool for business research,” *European Business Review*, vol. 26, no. 2, pp. 106–121, 2014.
[70] S. Ahmed, “Barriers to implementation of building information modeling (BIM) to the construction industry: a review,” *Journal of Civil Engineering and Construction*, vol. 7, no. 2, pp. 107–113, 2018.
[71] L. Liao and E. A. L. Teo, “Managing critical drivers for building information modelling implementation in the Singapore construction industry: an organizational change perspective,” *International Journal of Construction Management*, vol. 19, no. 3, pp. 240–256, 2018.
[72] Y. Gamil and I. A. R. Rahman, “Awareness and challenges of building information modelling (BIM) implementation in the Yemen construction industry,” *Journal of Engineering, Design and Technology*, vol. 17, no. 5, pp. 1077–1084, 2019.
[73] A. Rahman and T. Sainati, “Adapting standard forms of contract and technology to facilitate BIM,” *Proceedings of the Institution of Civil Engineers, Management, Procurement and Law*, vol. 175, no. 3, pp. 1–8, 2021.
[74] P. H. K. Ho, “Mapping out BIM contract conditions by way of a comparative study,” *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, vol. 13, no. 1, Article ID 05020017, 2021.
[75] C.-Y. Lee, H.-Y. Chong, Q. Li, and X. Wang, “Joint contract-function effects on BIM-enabled EPC project performance,” *Journal of Construction Engineering and Management*, vol. 146, no. 3, Article ID 04020008, 2020.
[76] A. Manderson, M. Jefferies, and G. Brewer, “Building information modelling and standardised construction contracts: a content analysis of the GC21 contract,” *Construction Economics and Construction*, vol. 15, no. 3, pp. 72–84, 2015.
[77] A. Mahdian, M. Parchami Jalal, and T. Yavari Roushan, “Contractual risks of BIM implementation and the proposed contract form for DBB and DB projects,” *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, vol. 15, no. 1, Article ID 06522003, 2023.
[78] A. H. Abd Jamil and M. S. Fathi, “Contractual challenges for BIM-based construction projects: a systematic review,” *Built Environment Project and Asset Management*, vol. 8, no. 4, pp. 372–385, 2018.
[79] F. Villena Manzanares, T. García-Segura, and E. Pellicer, “Effective communication in BIM as a driver of CSR under the happiness management approach,” *Management Decision*, 2023.