Rethinking Liabilities and Responsibilities: Towards a Balanced Risk-Sharing Framework in BIM

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Abstract: By enhancing digital collaboration, transparency, and efficiency across the project lifecycle, Building Information Modelling (BIM) has completely transformed the construction business. However, risk distribution, responsibility, and legal clarity are complicated issues with BIM-based projects, which frequently result in disagreements and a decline in stakeholder collaboration. The shared duties present in BIM settings are still not adequately addressed by current contractual frameworks. This paper argues for the necessity of developing an equitable risk-sharing model to enhance stakeholders' cooperative behavior in BIM-based construction projects. Rather than reporting empirical results, this paper positions the issue as a critical research gap in current BIM practices. Building Information Modelling (BIM) has revolutionized the way the construction industry works together, but it also creates new issues with risk distribution, responsibility, and liability. The shared obligations and complicated liabilities present in BIM systems cannot be adequately addressed by current contractual frameworks. This article makes the case that these difficulties necessitate a rethinking of how risk is distributed across BIM stakeholders. Rather than conducting new empirical research, this paper critically reflects on existing literature and positions the need for future research to develop frameworks that align fairness, trust, and cooperative behavior in BIM environments. This study illustrates how ambiguity in risk allocation affects trust, hinders collaboration, and leads to conflicts by synthesizing prior research. It finds that in order to increase collaboration, lessen conflict, and improve project efficiency, a fair and balanced risk-sharing structure is essential. In order to create, validate, and use an equitable risk-sharing model in BIM-based projects, the article urges further empirical research.

1. Introduction

This Building Information Modelling (BIM) has transformed the construction industry through centralized data platforms, real-time updates, and improved coordination across project lifecycles [1]. However, BIM also poses problems with liability, risk distribution, and the legal frameworks required to support its collaborative character. Determining culpability among many stakeholders is a crucial problem, especially in Level 2 and Level 3 BIM contexts where shared digital models obscure individual duties and raise questions about ownership and accountability for mistakes or omissions [2,3,4]. Such uncertainty can erode trust, trigger disputes, and hinder wider BIM adoption [5,6].

Existing legal and contractual frameworks remain inadequate, as BIM is often treated merely as an addendum to traditional contracts rather than integrated into core project obligations [7]. This overlooks evolving roles and collaborative workflows, leaving liability and risk management insufficiently addressed. This paper argues that successful BIM implementation requires an equitable risk-sharing model that aligns legal, contractual, and behavioral aspects of collaboration. Clear and fair allocation of roles, responsibilities, and liabilities fosters trust, reduces adversarial behavior, and supports shared accountability. In federated BIM environments, equitable frameworks encourage collective problem-solving and enhance project efficiency and quality [4]. Aligning stakeholder incentives is essential, as BIM workflows are highly interdependent and require strong cooperation [6]. One of the main causes of conflict, delays, and cost overruns is poorly defined risk distribution. Equitable frameworks minimise blame shifting, increase openness, and lessen the possibility of conflicts or litigation by making risk-sharing systems clear early on. They also support long-term collaboration across multi-phase projects and create positive precedents that strengthen industry cooperation and innovation. Such approaches can expand BIM adoption by attracting future collaborators and enabling joint-ventures [8].

Therefore, research is required to create a strong risk-sharing model specifically for BIM-based projects, one that enhances cooperation, increases clarity, and fills in existing legal and contractual loopholes. By fostering trust, coordinating incentives, lowering conflict, and promoting long-term digital integration in the sector, equitable risk-sharing may revolutionise stakeholder relationships.

As a result, this paper offers a conceptual research proposal that summarises the body of existing literature, identifies research gaps, and specifies goals for further empirical study. The proposed study is to design a model

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that improves cooperative behaviour in BIM-based construction projects, investigate stakeholder perspectives, and identify characteristics of fair risk-sharing.

2. Key Inquiry Areas Informing Future Research on BIM Risk Sharing

This study is guided by three interrelated research questions aimed at exploring the foundations for developing an equitable risk-sharing model in BIM-based construction projects.

Understanding how stakeholders see fair risk-sharing solutions in BIM-based building projects is a crucial need in existing BIM scholarship, which is highlighted by the first research question. Discussions that have already taken place have typically focused on legal or technological limitations, but the experiential and attitudinal aspects have not received enough attention. Fairness views among stakeholders influence their desire to cooperate, share information, and adopt BIM-enabled procedures. Future study must focus on understanding how various actors perceive accountability, responsibility, and justice in BIM contexts if perceptions impact the effectiveness of collaborative technology. Any suggested structure for fair risk sharing runs the danger of being out of step with project teams' actual circumstances in the absence of this fundamental understanding.

The second research question makes clear that identifying the attributes of equitable risk-sharing strategies and cooperative behaviour is an urgent next step. Meaningful reform cannot be informed just by perceptions unless they are converted into practical qualities like responsibility clarity, transparency, trust, and well-balanced incentives. Therefore, more study is required to map these characteristics methodically and investigate how they function in various project contexts. Future research may create the conceptual framework required to create a practical equitable risk-sharing model for BIM-based projects by progressing from descriptive descriptions of stakeholder sentiment to analytical clarity on what structural components truly define fairness. If the industry wants to transition from ad hoc methods to systematic, ethical approaches to addressing the risks associated with digital cooperation, this step is essential.

The third research question highlights the need for more empirical study in this area: in BIM contexts, the link between fair risk sharing and stakeholder engagement is still largely unproven. Although it makes sense to believe that fairness fosters trust and lessens conflict, there is not enough empirical data to support legislative or contractual reform. Therefore, future studies must use rigorous quantitative analysis to determine the nature, strength, and consequences of this link. The industry would have the evidence foundation required to support the adoption of new risk distribution models if it could empirically demonstrate that fair risk-sharing tactics produce observable advantages, such as enhanced performance, fewer conflicts, and better relationships.

When considered collectively, these enquiries suggest an urgent research priority. The construction sector can only advance towards creating a strong, fair, and cooperative risk-sharing framework designed for BIM-enabled projects by methodically investigating perceptions, characteristics, and relational dynamics.

2.1 Contractual Barriers and Their Impact on Risk Allocation in BIM-Based Projects

BIM implementation frequently encounters legal and contractual challenges that restrict effective collaboration and equitable risk allocation. Unclear model status, inconsistent standards, ambiguous liabilities, outdated contract conditions, and the lack of standardized BIM contracts collectively create uncertainty among project stakeholders [9].

Legal Status of the BIM Model: The BIM model often lacks formal contractual recognition, leaving its legal function uncertain and limiting accountability when design errors occur [4]. Kuiper and Holzer [10] argue that formally acknowledging the model as a “single source of truth” can enhance trust and transparency. In Malaysia and other regions, reliance on physical documents further weakens the enforceability of BIM outputs [11], causing risks to be informally and unevenly distributed.

Unclear BIM Standards and Protocols: Contracts that fail to specify BIM standards, roles, and deliverables lead to inconsistent interpretations and disputes [12]. Although frameworks such as AIA E203, ConsensusDocs 301, and the CIC BIM Protocol attempt to standardize BIM processes, their adoption and enforcement remain limited [13,14] emphasize the need for clear contractual references to relevant standards to ensure uniform digital collaboration.

Contractual Liabilities: BIM’s collaborative nature complicates the assignment of responsibility for errors or omissions [15]. The Information Manager’s role—critical for coordination—is often vaguely defined, creating accountability gaps [16]. Limitation-of-liability clauses may protect parties but can also unfairly shift risk and reduce trust, undermining cooperative behavior [17].

Unclear Conditions of Contract: Traditional contracts seldom include BIM-specific clauses such as model exchange schedules, data-sharing duties, or digital performance benchmarks. Without these, BIM obligations become unclear and may be unenforceable, increasing disputes and procedural confusion [18,19]. The absence of explicit BIM conditions contributes to uneven risk distribution and claims.

Limited Standardized BIM Contracts: Although documents like ConsensusDocs 301, AIA E203, and the CIC BIM Protocol were developed to address BIM’s legal challenges, their uptake remains low and much of their content is outdated. More recent tools—such as NEC4 Option X10 and FIDIC’s advisory notes—offer digital collaboration guidance but are not legally binding, resulting in inconsistent application across jurisdictions [20]. Without a unified BIM-specific contract, key issues such as authorship, data ownership, and IPR remain unclear [4].

Overall, contractual barriers shape how risks are distributed in BIM-based projects. Inconsistent standards, outdated provisions, and the lack of legally recognized BIM deliverables shift uncertainty onto individual parties rather than enabling fair distribution. Therefore, stakeholders often resort to defensive contracting that transfers—rather than shares—risk. This fragmented accountability undermines transparency and discourages the cooperative intent required for effective BIM collaboration.

2.2 Risks and Uncertainties in BIM Projects

Through data integration, collaboration design, and effective project execution, Building Information Modelling (BIM) promotes digital transformation. However, the hazards posed by its interrelated processes put conventional legal, technological, and organisational systems at risk. Legal and contractual, technical, data-related, organisational, financial, and human or cultural risks are the six main risk categories identified by earlier research.

Legal and Contractual Risks: Because traditional contracts are not designed for digital cooperation, concerns about ownership, responsibility, and intellectual property rights continue to be significant obstacles to the adoption of BIM [3,8,9]. Concerns about the legality and acceptability of BIM models as evidence hamper accountability [21]. Frameworks such as the CIC BIM Protocol and ISO 19650 specify ownership, sharing, and duty [22, 23], but consistent legislative action is needed to enable clear and consistent accountability mechanisms.

Technological and Data-Related Risks: Technological challenges such software incompatibility, cybersecurity vulnerabilities, and interoperability issues pose a severe threat to the use of BIM [24,25,26]. Data risks including unauthorised access, manipulation, or loss can lead to design defects and delays. These problems highlight shortcomings in digital governance and highlight the necessity of strong cybersecurity procedures backed by thorough BIM Execution Plans (BEPs), secure systems, common data environments (CDEs), and interoperability standards such as IFC.

Organizational Risks: Organizational readiness has a significant impact on BIM success. Implementation is frequently hampered by poor leadership, fragmented workflows, ambiguous responsibilities, and poor communication [27, 28, 29]. The collaborative nature of BIM may clash with traditional hierarchical management approaches [30]. To cut down on inefficiencies and prevent conflicts, it is crucial to strengthen BIM governance, define responsibilities, and encourage cooperative behaviour [31].

Financial Risks: High software, hardware, and training investment costs continue to be major barriers, particularly for SMEs [32]. Training, subscription fees, and updates are examples of ongoing costs that can cause budget overruns and deter adoption [31]. Incentives, subsidies, collaborations, and increased industry knowledge of BIM's long-term cost advantages can all help reduce financial risks.

Overall, BIM risks are closely related. Technological malfunctions may result in monetary losses, and legal ambiguities may intensify organisational and contractual issues. Effective BIM risk management thus requires an integrated approach that strikes a balance between financial planning, technological reliability, regulatory clarity, and human capacity development.

3. Future Directions

3.1 Equitable Risk-Sharing Model for BIM Construction Project

Building Information Modelling (BIM) has transformed project delivery through improved coordination, transparency, and efficiency across the construction lifecycle [6]. Yet its collaborative, data-driven nature challenges conventional risk allocation and legal structures. Many contracts still treat BIM as an addendum rather than a core project management tool, resulting in fragmented accountability and weak enforceability [3].

Although jurisdictions like the United States, United Kingdom, and Singapore have adopted frameworks such as AIA E203, ISO 19650, and BCA guidelines, Malaysia's BIM legal infrastructure remains limited. Existing instruments—PAM 2006, CIDB Guidelines, and the JKR BIM Roadmap—lack binding provisions on ownership, liability, and coordination, reducing their legal effect [33]. Traditional standard forms such as FIDIC, JCT, and NEC were not designed for BIM's collaborative environment. Simply attaching BIM protocols without revising core terms weakens their authority [34]. As studies show, persistent technical, managerial, financial, and legal risks continue to arise in BIM practice [35], causing stakeholders to hesitate in fully adopting BIM where responsibilities remain unclear.

The mismatch between static contract documents and dynamic BIM workflows further complicates accountability. Tools like the Model Element Table (MET) and BIM Execution Plan (BEP) under AIA E203 are often unenforceable in practice. This highlights the need for a new framework—such as the Equitable Risk Sharing Model proposed in this study—to embed fairness, dynamic allocation, and cooperative behaviours. Likewise, Trant Engineering Ltd v Mott MacDonald Ltd illustrates how overlapping duties and centralized BIM access can lead to disputes.

These issues show that while BIM enhances efficiency, it also intensifies interdependencies that require transparent and equitable risk frameworks [36]. Traditional risk strategies are insufficient in such multi-party digital settings. This has led to growing interest in risk-sharing approaches, as fair allocation of risks enhances trust, discourages opportunism, and improves performance.

By aligning risks to the capabilities and obligations of each stakeholder, equitable—not equal—risk sharing advances justice. It strengthens responsibility and confidence, both of which are necessary for productive BIM cooperation [37]. Fairness and shared incentives are necessary to maintain cooperation, according to theoretical viewpoints such social exchange theory [38], game theory [39], and collective action theory [40].

Even with this acknowledgement, current BIM risk distribution models are still fragmented and insufficient. This emphasises the need for a new framework, like the Equitable Risk Sharing Model put forth in this study, to incorporate cooperative behaviour, fairness, and dynamic allocation into the delivery of BIM projects. This will increase trust, lessen conflict, and align stakeholder interests towards a more collaborative construction culture.

4. Conclusion

This paper highlights the urgent need for an equitable risk-sharing framework to improve stakeholders' cooperative behavior in BIM-based construction projects. Instead of presenting empirical data, it highlights a crucial research gap by synthesising the available evidence. The conversation shows how BIM's potential for collaboration is hampered by present legal and contractual ambiguities. In order to create and evaluate egalitarian frameworks that define roles, foster trust, and reduce conflict, the paper's conclusion calls for more empirical and theoretical research. In order to turn BIM from a technical tool into a collaborative platform for sustainable project delivery, such future research will be crucial.

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