



# Comparative Analysis of Existing Contracts for Building Information Modelling (BIM) Projects in Malaysia and Selected Common Law Countries

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**Abstract:** The Malaysian construction scene has been striving forward towards modernisation since the mention of Vision 2020. It includes innovative prowess in technology as it reaches Construction 4.0 within the field. Building Information Modelling (BIM) has been an alternative towards some of the long-standing issues. However, its adoption remains slow despite the potential for an integrative collaboration within projects. The unreceptive drive is said to be associated with contractual setbacks which hold back the adoption. The existing standard form of contracts is with the view which lacks facilitation towards BIM's specific roles, process and outcome. Hence, a necessity arises for the need to include changes towards the incorporation of BIM. This study employs a narrative literature review using a systematic review approach using the terms BIM, contract, BIM contract, procurement, legal, and contractual problems. This paper, therefore, is with the aim of a comparative analysis of existing contractual provisions for Malaysia against other selected common law countries. The contractual discrepancy observed in BIM's legality has already been resolved by developed countries namely the United Kingdom and Singapore for contract administration success. Nonetheless, the status of the construction industry remains contentious in Malaysia.

**Keywords:** Building Information Modelling (BIM), construction industry

## 1. Introduction

The construction industry is a dynamic faceted industry of various participating parties and disciplines involved bringing together individuals from varied backgrounds in segmentation, with project participants working in isolation (Hardin & McCool, 2015). It is receptive to potential conflict leading to dispute, disparities in objectives (Yusoff et. al., 2020), and misinterpretation due to the nature of a project's complexity (Utama & Irsan, 2018, Aminuddin, 2019, Sarairoh et. al., 2020). While the construction sector has mostly retained a traditional approach, the technological tsunami of digitalisation is still there. With the development of technology, Building Information Modelling (BIM) has been found to add benefit to the administration of a construction project through its potential. Its use has been steadily increasing as it has aided construction companies in its operations (Dixit et. al., 2019, Hardin & Mccool, 2015). BIM can be identified as a set of activities that involves planning, design, construction, operation and maintenance in its lifecycle (Zhang & Gao, 2019, Autodesk, 2019, Latiffi et. al., 2013). BIM's capacity to compute project exploration digitally assesses future design solutions, preventative measures, and quick design adjustments in various stages of a

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project's life cycle (Cepurnaite, Ustinovicus, & Vaisnoras, 2017, Chien et. al., 2017, Araszkievicz, 2017, Raja Berema, 2020). Nonetheless, contractual issues originating from BIM-based construction projects pose uncertainty and problems. There is no complete examination of the legal challenges surrounding BIM, nor are the remedies now available to resolve the difficulties evaluated (Fan et. al., 2018). This is found concerning the present contractual procedure which was not designed for the advancement of BIM (Hasni et. al., 2019, Abd Jamil & Fathi, 2018, Chong et. al., 2017, Alwash et. al., 2017, Sacks et. al., 2016, Mosey et. al., 2016, Manderson et. al., 2015). Therefore, this paper aims to uncover a contractual framework for BIM public projects in Malaysia.

## 1.1 Research Methodology

The study of this paper is with the objective to review the Malaysian use of contracts for BIM public projects at present, and similar common law countries of United Kingdom and Singapore. It takes reference to scholarly publications derived mainly from electronic and paper journal articles, government articles and publications, presentation slides, conference proceedings, articles and books through a narrative literature review. It follows a systematic review method to analytically analyse data through an exhaustive summation of available evidence present (Grant & Booth, 2009). To achieve an effective outcome, topics along the proximity of BIM, contract, BIM contract, procurement, legal and contractual issues have been used as keywords. The data was then extracted to gain an insight on what are the BIM legal issues, why it needs to be addressed, how to overcome it and who is responsible for it.

## 2. Literature Review

### 2.1 Malaysian Construction Industry

The Malaysian construction sector has a reputation for being a change-resistant industry that has maintained traditional business practices for decades. As a vital sector contributing yearly towards the nations Gross Domestic Product (GDP) (Rashidi & Ibrahim, 2017; Mamter, Abdul-Aziz & Mamat, 2017, CIDB, 2020), the Malaysian government has been extending support and measures to accelerate the industry's growth in an effort to a modernised Malaysia (Hamid & Kamar, 2010, Khan, et. al., 2014). The effort has first begun with Vision 2020 in 1990 to mitigate issues of safety, health, and the lack of skilled manpower (CIDB, 2008). Following this, the Construction Industry Development Board (CIDB) was formed as a statutory body and the Construction Industry Research Institute of Malaysia (CREAM) was formed in 2004 towards innovative research and development (R&D) (CIDB, 2015). For a competitive and sustainable industry, the Construction Industry Master Plan (CIMP) was established from 2006 to 2015 (Sundaraj, 2006, CIDB, 2008, Hamid & Kamar, 2010). Moving forward, another program under the Construction Industry Transformation Programme (CITP) was drawn for 2016 to 2020 to increase digital technology in the direction of innovation and transformation (Noor et. al., 2018; Rashidi & Ibrahim, 2017). Concurrently, as a government agency, the Public Works Department (PWD) in their strategic plan of JKR Strategic Plan 2015 to 2020 has pioneered their asset management towards information and communications technology (ICT) (Jabatan Kerja Raya Malaysia, 2016). At present, as Malaysia's construction industry continues to grow, the Construction 4.0 Strategic Plan 2021-2025 has been formulated to become a regional leader in the field of construction. Policymakers continue to place technology at the centre of their efforts as a solution to solve the issue of construction being an autonomous process (CIDB, 2020).

### 2.2 Construction Standard Form of Contract

Achieving a completely synchronised construction project, while ideal, is not always possible. This is due to the involvement of multiple parties with a variety of abilities and specialities. While a standard construction project allocates risks within an agreement, its foundation returns the consensus ad idem or Agreement which is often overlooked and misinterpreted (Greenwood et. al., 2010). During the contract administration process, a standard form of contract is employed to control contractual duties and expectations of project parties (Utama & Irsan, 2018). According to Coiller stated in Ho (2010), a thorough grasp of contracts is required to completely comprehend contract management. A contract is a written agreement between contracting parties that binds them and defines their responsibilities and duties in a specific project (Chong et. al., 2009; Ho, 2010, Utama & Irsan, 2018, Zolkafli et. al., 2011).

The standard form of contract is a written document that is acknowledged and agreed upon by both parties and is issued by an official authority within the industry (Ho, 2010). While standard forms are typically adequate for a wide variety of typical projects (Ho, 2010), they have a strict structure that does not allow for discussions and/or revisions, which is especially important with the progress of BIM. The PWD 203A (Revised 10/83) is a standard type of contract frequently used by Malaysian public sector institutions, especially the Malaysian Public Works Department (PWD). For more than 30 years, the industry has employed the form of contract for its contractual methods (Chong et. al., 2009, Ho, 2010, Zolkafli et. al., 2011, Udin, 2020). Other forms of the contracts include PAM 2006 by Pertubuhan Arkitek Malaysia (Ho, 2010, Udin, 2020), Construction Industry Development Board (CIDB) contract for Building Works, IEM forms (Ho, 2010), and the Asian International Arbitration Centre Standard Form of Building Contract 2019 (Udin,

2020). International contracts, meanwhile, include Fèdération Internationale des Ingènieurs- Conseils (FIDIC) (Ho, 2010) and Joint Contracts Tribunal (Zolkafli et. al., 2011).

### 2.3 Building Information Modelling (BIM) Concept

As one of the contributing technological advancements, BIM has been found espoused with information exchange through a set of processes across its lifecycle (Latiffi et. al., 2013, Zhange & Gao, 2019, and Autodesk, 2019) using a tool (Latiffi et. al., 2013, and Mamter, Abdul-Aziz & Mamat, 2017) digitally (Zhange & Gao, 2019) in a three-dimensional format (Autodesk, 2019). Its inception in the 1980s as object-based modelling contributed to its adoption within the construction industry (Hardin & Mccool, 2015) towards mitigating issues associated with the traditional method of construction which works in segmentation (CIDB, 2008, Hardin & McCool, 2015). BIM's transformative improvements bring together not just modelling (3D), but also scheduling (4D), pricing (5D), sustainability (6D), and operation and maintenance (O&M) in a single collaborative effort (7D). Further, its value towards a successful platform comes in association with its tools, processes, and behaviour (CIDB, 2019b). BIM's initialisation within the Malaysian construction industry began in 2007 by PWD for public projects while campaigns facilitated by CIDB within private projects (CIDB, 2019a). It has helped the construction sector to improve its efficiency, production, and quality. Nonetheless, in comparison to nations like the United Kingdom, which has a high adoption rate of 95 per cent (Mohammad et. al., 2018), and Singapore, which has a 65 per cent adoption rate, Malaysia has a low adoption rate of 17 per cent. The lack of acceptance by the industry is often associated with the challenges found in people, processes, and technology (CIDB, 2017).

**Table 1 - BIM stages in Malaysia**

Stages	0 Manual	1 Modelling	2 Collaboration	3 Integration
	2D Manual and CAD-based (2D or 3D)	Single disciplinary use of object-based modelling software within one discipline	Sharing of object based 3D models and data between two or more disciplines	Integration of several multi-disciplinary models and data using model server or other network-based technologies
Business Model	Isolated	Collaborative	Integrated	Isolated
BIM Usage Timeline	Representation	Prototype	Full information capture	Representation

(Source: CIDB, 2017)

### 3. Findings

The performance of a building project is frequently a consideration in the selection of contractual forms. Its choice is determined by the project's owner or employer, the project's kind and character, and the project's funding. The correct contractual decision substantially aids all project participants in achieving a successful and efficient end (Zolkafli et. al., 2011 and Zakaria et. al., 2013). However, the legal positions of BIM legal concerns and their remedies may differ depending on localities. This is due to differences in the implementation of the economic loss concept, according to research by Fan et. al. (2018).

#### 3.1 United Kingdom (UK)

The UK, according to McAdam (2010), has endorsed partnering and collaborative procurement methods in BIM projects through New Engineering Contract (NEC3) (CMS Expert Guide, 2017; Croner-I, 2016; Jo et. al.,2018), Joint Contracts Tribunal (JCT) (CMS Expert Guide, 2017; Croner-I, 2016; Alwee et. al., 2021), Constructing Excellence Contract (CE) (CMS Expert Guide, 2017; Croner-I, 2016) and Project Partnering Contract (PPC 2000) (CMS Expert Guide, 2017; Croner-I, 2016). These management tools allow for individually negotiated aspects within its management framework which has been deemed suitable for BIM delivery. Other standard forms of contracts includes the Scottish Building Contracts Committee (SBCC) contract (CMS Expert Guide, 2017), the NEC4 Engineering and Construction Contracts 2018 which has been integrated with the CIC BIM Protocol (Alwee et. al., 2021), the Chartered Institute of Building (CIOB) Contract for Use with Complex Projects contract (CMS Expert Guide, 2017) which the Time and Cost Management Contract have been amended and reprinted in 2016 (Croner-I, 2016; Alwee et. al., 2021) and the FIDIC contract (CMS Expert Guide, 2017).

The BIM Protocol acts as an agreement which have been standardised to be included within a contractual agreement by The Construction Industry Council of the United Kingdom (UK) (Atkinson, 2014; The BIM, 2021). This allows for its goals to make BIM inclusive within a project be realised. Hence, advantageous to industry players as it promotes collaborative practice in its contractual requirement. The BIM Protocol is built on a direct contract between the employer and the supplier, hence, follows a standard contract to the contract with editable appendices within the Protocol (The BIM, 2021). Existing forms of contracts has been created with the absence of BIM, therefore, the Protocol acts as a means in present amendments for the use of BIM Level 2 projects.

In an effort by its government and institution bodies, strategies, policies, standards and processes have been integrated and designed to give thorough, consistent direction to businesses of all sizes and specialties. Notable standard of PAS1192-2:2013 acts as a guiding document specifically offers solution to the management of BIM environment. BS 1192, meanwhile, establishes regions inside a shared data environment and offers a structure for naming and categorising models, drawings, and documents (Atkinson, 2014). While the UK is gearing towards BIM Level 3, its industry is to rework its contracts as BIM Level 3 is further digitised in its workflow (The BIM, 2021). Further identification of BIM contractual standard has been identified as per Table 2.

**Table 2 - Table of findings for United Kingdom**

Provisions	United Kingdom
Standard Form of Contracts	<ul style="list-style-type: none"> <li>● JCT contract (CMS Expert Guide, 2017, Croner-I, 2016, Alwee et. al., 2021)</li> <li>● Scottish Building Contracts Committee (SBCC) contract (CMS Expert Guide, 2017)</li> <li>● NEC3 contract (CMS Expert Guide, 2017, Croner-I, 2016, Jo et. al., 2018)</li> <li>● NEC4 Engineering and Construction Contracts 2018 (integrated with CIC BIM Protocol) (Alwee et. al., 2021)</li> <li>● Chartered Institute of Building (CIOB) Contract for Use with Complex Projects contract (CMS Expert Guide, 2017). In 2016, the Time and Cost Management Contract was amended, and reprinted. (Croner-I, 2016, Alwee et. al., 2021)</li> <li>● FIDIC contract (CMS Expert Guide, 2017)</li> <li>● Association of Consultant Architects (ACA) PPC 2000 contract (CMS Expert Guide, 2017, Croner-I, 2016)</li> <li>● JCT CE contract (CMS Expert Guide, 2017, Croner-I, 2016)</li> </ul>
BIM Contract Guidelines	<ul style="list-style-type: none"> <li>● CIC/BIM Protocol (CMS Expert Guide, 2017, Marsh, 2014, Croner-I, 2016, Chong et.al., 2017, Alwee et. al., 2021, Dao et.al., 2021)</li> </ul>
Function	Add-on contract clauses (Croner-I, 2016)
National Technical Standards	<ul style="list-style-type: none"> <li>● BS 1192/PAS1192 (Marsh, 2014; Sacks, 2016; Dao et.al., 2021; Sacks, 2016)</li> </ul>

### 3.2 Singapore

Singapore, an ASEAN country like Malaysia has implemented BIM in its country following the implementation model adopted in the UK (Dao et.al., 2021). According to Kaneta et. al. (2016), BIM has been actively promoted in Singapore to minimise the number of foreign skilled employees employed in the sector. The Singaporean government's approach in BIM adoption brings together stakeholders, emphasising the collaborative component of BIM (Kaneta, et. al., 2016). The Singapore Building and Construction Authority (BCA) established the BIM Roadmap in 2010 to address the country's specific circumstances. As a result, the BCA, in collaboration with government procurement entities (GPEs), has increased the need for BIM implementation to begin in 2012. The BCA then issued The Singapore BIM Guide (Thant, 2014; Kaneta, et. al., 2016) and The BIM Special Conditions the following year. As a consequence, it gives a comprehensive understanding of BIM throughout the lifespan of a project through document incorporation to the Principal Agreement (Thant, 2014). BCA as an authoritative body have continuously provide solutions towards the national BIM guidelines and standards to be implemented throughout the nation for enforcement. Following this, the Institutes of Higher Learning (IHL) in Singapore were engaged as to be incorporated towards BIM expansive usage for their construction industry.

As the guide acts as an attachment similar to the one adopted in the UK, it allows for various standard form of contracts to be used for BIM projects. A number of contracts identified by the Building and Construction Authority (2020) includes the Real Estate Developers' Association of Singapore (REDAS) Design and Build Conditions of Main Contract, 3rd Edition, REDAS Design and Build Sub-Contract Conditions, 1st Edition, Singapore Contractors Association Limited (SCAL) Conditions of Sub-Contract, SCAL Standard Agreement for Appointment of Consultants, Singapore Institute of Architects (SIA) Articles and Conditions of Building Contract, 9th Edition, SIA Conditions of Sub-Contract for use in conjunction with the Main Contract (Lump Sum Contract and Measurement Contract, 8th and 9th Edition), SIA Articles and Conditions of Contract for Minor Works 2012, 1st Edition, SIA Conditions of Appointment and Architect's Services and Mode of Payment, 3rd Edition and Association of Consulting Engineers Singapore Agreement. The findings for Singapore has been categorised within Table 3 as follows.

**Table 3 - Table of findings for Singapore**

Provisions	Singapore
Standard Form of Contracts	<ul style="list-style-type: none"> <li>● Real Estate Developers' Association of Singapore (REDAS) Design and Build Conditions of Main Contract, 3rd Edition (Building and Construction Authority, 2020)</li> <li>● REDAS Design and Build Sub-Contract Conditions, 1st Edition (Building and Construction Authority, 2020)</li> <li>● Singapore Contractors Association Limited (SCAL) Conditions of Sub-Contract (Building and Construction Authority, 2020)</li> <li>● SCAL Standard Agreement for Appointment of Consultants (Building and Construction Authority, 2020)</li> <li>● Singapore Institute of Architects (SIA) Articles and Conditions of Building Contract, 9th Edition (Building and Construction Authority, 2020)</li> <li>● SIA Conditions of Sub-Contract for use in conjunction with the Main Contract (Lump Sum Contract and Measurement Contract, 8th and 9th Edition) (Building and Construction Authority, 2020)</li> <li>● SIA Articles and Conditions of Contract for Minor Works 2012, 1st Edition (Building and Construction Authority, 2020)</li> <li>● SIA Conditions of Appointment and Architect's Services and Mode of Payment, 3rd Edition (Building and Construction Authority, 2020)</li> <li>● Association of Consulting Engineers Singapore Agreement (Building and Construction Authority, 2020)</li> </ul>
BIM Contract Guidelines	<ul style="list-style-type: none"> <li>● Singapore BIM Guide (Thant, 2014; Sacks, 2016) Version 1.0 and 2.0 (Singapore Government, 2021)</li> </ul>
Function	To be attached to contracts in BIM projects (Singapore Government, 2021)
National Technical Standards	<ul style="list-style-type: none"> <li>● BCA (Building &amp; Construction Authority) (Dao et.al., 2021)</li> <li>● NUS (National University of Singapore) (Dao et.al., 2021)</li> </ul>

### 3.3 Malaysia

Within the Malaysian construction scene, for the public projects and development, the PWD 203A Form of Contract is commonly utilised (Zolkafli et. al., 2011; Zakaria et. al., 2013; Udin, 2020) while PAM 2006 by Pertubuhan Arkitek Malaysia (Udin, 2020), CIDB contract for Building Works, Institute of Engineers, Malaysia (IEM) and the Asian International Arbitration Centre Standard Form of Building Contract 2019 (Udin, 2020) forms are some of the other contract types (Ho, 2010; Abdullah, 2019; Tan, 2010; Oon, 2002). FIDIC (Ho, 2010; Abdullah, 2019; Tan, 2010) and JCT (Zolkafli et. al., 2011; Tan, 2010), meanwhile, are two examples of international contracts. Standard forms of

contracts are found to be expansive, with various forms of contracts readily available for a legal relationship between parties (Yunus et. al., 2018). Nonetheless, existing contracts remains devoid of BIM solutions (Abd Jamil & Fathi, 2018; 2020; Abd Jamil, 2020; CIDB, 2019b; Foster, 2010; Kamal Hasni et. al., 2019; Jo et. al., 2018). A standard form while typically acceptable for a wide range of common projects have a strict structure that does not allow for discussions and/or adjustments, especially as BIM advances (Ho, 2010). According to Alwee et. al., (2021), solution in mitigating the contractual solutions towards BIM could ease BIM's implementation for public sector construction projects. Two (2) technical standards in BIM's data environment has been prepared through CIDB BIM Guide, PWD BIM Guidelines, Standards and Manual Working Process and JKR BIM Requirements for Design and Build Projects 2016, Malaysia (Alwee et. al., 2021). Findings for Malaysia have been identified as per Table 4 as follows.

**Table 4 - Table of findings for Malaysia**

Provisions	Malaysia
Standard Form of Contracts	<ul style="list-style-type: none"> <li>● PAM Contract 2006 (Jo et. al., 2018; Chong et. al., 2009; Ho, 2010; Zolkafli et. al., 2011)</li> <li>● CIDB Standard Form of Contract for Building Works 2000 Edition (Jo et. al., 2018)</li> <li>● IEM Forms (Ho, 2010)</li> <li>● FIDIC Form of Contract (Abd Jamil et. al., 2017; Ho, 2010)</li> <li>● JCT contract (Zolkafli et. al., 2011)</li> <li>● Asian International Arbitration Centre (AIAC) Standard Form of Building Contract 2019 (Udin, 2020)</li> </ul>
BIM Contract Guidelines	There is no common contract structure or BIM guide. (Jo et. al., 2018; Abd Jamil & Fathi, 2018; 2020; Abd Jamil, 2020; CIDB, 2019b; Foster, 2010; Kamal Hasni et. al., 2019)
Function	Facilitate BIM public projects (Alwee et. al., 2021)
National Technical Standards	<ul style="list-style-type: none"> <li>● CIDB BIM Guide, PWD BIM Guidelines, Standards and Manual Working Process (Alwee et. al., 2021)</li> <li>● JKR BIM Requirements for Design and Build Projects 2016, Malaysia (Alwee et. al., 2021)</li> </ul>

#### 4. Discussions

With reference to the findings found, the United Kingdom, Singapore, and Malaysia each have their own form of contract particular to their respective country. A number of eight (8) major contracts have been found to be used for BIM projects in the United Kingdom while ten (10) major contracts in Singapore. Malaysia, meanwhile, has five (5) major contracts in adoption non-exhaustive to only BIM projects. While international contracts are available, it is not often the selective form of contract opted by industry players unless specified by the client. International contracts, namely the FIDIC and JCT form of contracts, are similar between Malaysia and the United Kingdom. Further, Singapore's BIM contracts are mostly personalised for the use of contracts internally within Singapore. The United Kingdom and Singapore both have advanced their contractual remedy to be included within the selected contracts within their BIM projects. The United Kingdom contractual guidelines are to follow CIC/BIM Protocol, while Singapore follows its Singapore BIM Guide. While there is a standard form of contract for building projects, there have yet to develop a complete BIM contractual framework and a standard guide that addresses the BIM contractual conditions of parties' relationships in a BIM project in Malaysia. BIM, being a collaborative platform, necessitates the sharing of design information via a standardised file format for data integration. Both United Kingdom and Malaysia are in BIM Level 2 'Collaborative BIM' with the United Kingdom, in particular, uses the contract within the construction phase. The national technical standards too differ according to the nations' localities.

#### 5. Conclusion

Developed nations have long addressed the contractual disparity found within BIM's legalities. To overcome the legal issues of BIM's adoption, it is beneficial to look into common-law countries like the United Kingdom and Singapore for their success in their contract administration. The act of entering BIM-related terminology may be simple, yet it may be over-simplistic since gaps and inconsistencies are unavoidable. This may be observed in the lack of consistency in the form and substance of many contract papers. While some norms are addressed, there may be substantial variance and flexibility within contracts for various projects. Malaysia, while having long addressed the need and the importance of the usage of BIM, have been found to be devoid of any contractual framework. While a BIM guideline has been formed for its use, its contractual aspect remains a blur for organisations which impedes the adoption. Government public projects act as a precedent for industry players to adopt and follow through, hence, act as a guideline for the construction industry in Malaysia to adopt BIM. The contribution of this research would greatly assist in the extension of the existing BIM guideline and its body of knowledge for BIM-based contract administration.

## Further Works

The outcome from this research will be used towards for the development of the Malaysian BIM public projects contractual framework.

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