



# Identification of Skills among BIM Coordinators in the Malaysian Construction Industry

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**Abstract:** Building Information Modelling (BIM) is the current trend in the Malaysian construction industry. It has evolved from 'What is BIM?' to 'How to use BIM?' In the current market, numerous positions have been created for organisations to implement BIM. In Malaysia, the most common BIM position is the BIM Coordinator. However, there is a lack of information when it comes to the necessary BIM skill sets. Many positions are created for the sake of fulfilling contract purposes since the BIM implementation is mandated by the local government. Hence, this paper aimed to identify the skills required for BIM coordinators by reviewing papers by researchers throughout the decade. The identified BIM skills can give a brief concept of the necessary requirement to become a BIM coordinator. Also, the prospective BIM coordinators can use the identified BIM skills in this paper as a guide. This paper has identified four main skills that can be categorised as both BIM technical and non-technical skills namely BIM tool skills, multi-trade coordination, communication as well as collaboration.

**Keywords:** Building information modelling (BIM), BIM skills, BIM coordinator, Malaysia

## 1. Introduction

Building Information Modelling (BIM) can be regarded as a product, modelling method, or even a methodology, depending on its uses when implemented (Matějka & Tomek, 2017). Not only it is software, it is also a three-dimensional (3D) building design that organises and visualises all building data before the actual design is made (Latiffi & Ng, 2019). BIM has proven to be a beneficial technology in the construction industry (Bosch-Sijtsema et al., 2019), allowing users to reduce time and cost uncertainties to complete a project.

The advantages of BIM include better structure, reduced issues, and expanded project productivity (Chou & Chen, 2017). A better plan delivered permits designers, contractual workers, and engineers to better comprehend the structure through a 3D or four-dimension (4D) display. Through the 3D or 4D demonstrations, BIM can identify a few issues during the primer stage (Yuqi & Jiajia, 2018), such as structure conflicts and cost invasion. Doumboya, Gaoand, and Guan (2016) abridge a few advantages which are better structure appraisal amid primer stages and diminished budgetary hazard because of the exact cost estimation and conflict discovery forms.

In Malaysia, the construction industry plays an imperative job in constructing the nation's economy and has demonstrated an unfaltering performance throughout the years. This industry is one of the gainful industries that has contributed to the Malaysian economy to empower the construction of different projects. The significance of the construction industry has been recognised and incorporated into the Eleventh Malaysia Plan. Moreover, this industry distributes the work of experts, for example, draftsmen, architects, and surveyors, to primary temporary workers,

subcontractors, and providers (Uhm, Lee & Jeon, 2017). Unquestionably, BIM will create new employments, explicitly by amplifying the use of BIM. The improvement of different programming bundles and the requirement for liking will likewise guarantee the imperative aptitude base for future BIM conveyance (CIOB, 2013).

As Malaysia concentrates on BIM usage and numerous activities being made (CIDB, 2016), this may prompt organisations to enrol specialists with BIM abilities or upskill their current workforce to remain aggressive and in accordance with the government’s approach. Many new positions are being created for BIM teams, such as BIM manager, BIM coordinator, and BIM modeller. A BIM coordinator is often responsible for all stages and is involved in all design project teams (Fathi, Daud, & Baharum, 2017). The main role of a BIM coordinator is to act as a middleman to build relationships and manage interdependencies with other construction players to resolve issues in order to bring about an agreement or when information conflicts arise (Jacobsson & Merschbrock, 2018). It shows the significance of exploring the required skills to shape competent BIM coordination. The industry will anticipate that future representatives be furnished with information and abilities, mainly through its developing interest in construction experts with BIM technical and non-technical skills (Sacks, Korb, & Barak, 2017). Therefore, this paper explains the role of BIM coordinators and the skills required.

## 2. Methodology

The method selected was a literature review based on previously published journals. The main sources include Google Scholar, Conference Proceedings, and also scholarly publications such as Scopus and Elsevier. The selected journals were chosen based on the main theme of the current paper which were BIM Skills and a few criteria set during preliminary studies. The criteria were tabulated in Table 1.

**Table 1 - Criteria of selected journals**

Inclusion	Exclusion
<ul style="list-style-type: none"> <li>• Theoretical Qualitative Research</li> <li>• Sources written in English language</li> <li>• Sources published within 2000 - 2019</li> </ul>	<ul style="list-style-type: none"> <li>• Arguable Research</li> <li>• Sources written in other Languages</li> <li>• Sources published before 2000</li> </ul>

In addition, a snowball method was deployed to identify more related journals. A total of 275 articles papers were eligible for review. The papers were analysed and sorted to identify their essential points. -It was found that more research was conducted on construction skills than BIM skills. This is identified as one of the limitations of this research.

## 3. BIM Project Team

Many new roles and new people are entering the construction industry, but about 58.59 percent concur that the players in the industry do not have sufficient BIM abilities (CIOB, 2013). Barison and Santos (2011) arrange BIM employment, through job search platforms in the United States (US), into eight categories, namely BIM chief, BIM modeller, BIM mentor, BIM executive, BIM specialist, BIM advisor, BIM advertising supervisor, and BIM engineer. In Malaysia, three (3) BIM jobs have been distinguished: BIM manager, BIM coordinator, and BIM modeller (CIDB, 2016).

These activity jobs can be additionally sorted into project jobs and hierarchical jobs. Employment jobs that fall under the category of project jobs fit within a project team, while occupation jobs under authoritative jobs are fundamental to be performed at the organisation level (Davies, Wilkinson, & McMeel, 2017). In any case, these activity jobs ought to have an unmistakable portrayal to recognise them and their depictions can be found in any accessible BIM guides; even it is uncommon for an organisation to audit BIM guides since they frequently incorporate characterised portrayals of employment jobs that are more organisation-based than extension-based (Hosseini et al., 2018). A few handbooks, likewise, characterise BIM-based occupation jobs with the organisation level BIM forms, in particular the authoritative BIM administrator and BIM modeller (Wu et al., 2017).

The Singapore BIM Guide expresses that the Design BIM Organiser is in charge of a given arrangement of errands, ‘characterise discipline-explicit BIM utilises including investigation, coordinate between BIM modellers, plan specialists and cost expert, coordinate with temporary worker and subcontractors, and ensure Modelling Quality Control’ (BCA, 2013). Meanwhile, for a similar job, the NATSPEC (2016) direction is considerably more explicit in characterising desires for the job:

‘These people will have the significant BIM experience required for the multifaceted nature of the project and will have, as a base, the accompanying obligations regarding their order: Coordinating specialized order BIM

advancement, principles, information necessities, and so on as required with the Design Team BIM Manager; Leading the specialised order BIM group in its documentation and research endeavors; Coordinating conflict recognition and goals exercises; Coordinating exchange things into the Design BIM (contingent upon acquirement plan).’

These roles are defined to ensure the BIM project teams can complement each other to ensure the success of a project.

### 3.1 BIM Coordinator

A BIM coordinator leads a project on the fundamentals and gives assurance backing the project group for both work and self-improvement (Fathi, Daud, & Baharum, 2017). The role of BIM coordinators mainly covers the design and production phases (Jasobsson & Merschbrock, 2018). Individuals taking on this role are required to have a good understanding of technology (technical skills), process (BIM and construction methodology), and non-technical skills (Bosch-Sijtsema, Gluch & Sezer, 2019). Thus, the industry anticipates its future representatives to be furnished with information and abilities, particularly through its developing interest in construction experts with BIM technical and non-technical skills (Sacks, Korb, & Barak, 2017).

Bosch-Sijtsema, Gluch, and Sezer (2019) explain that the role of BIM coordinators has developed over the years from a technical focus to a more integrated coordination focus. This observation is in line with other observations of BIM coordinators as conventionally having only technical competencies and with a later observation of the needs of BIM coordinators to possess skills in ‘leadership, communication, documentation writing, review, and quality assurance procedures’ (Davies et al., 2014). Others describe the rationale for the new role as being based on the need to perform modelling and coordination tasks following BIM implementation (Poirier et al., 2015), to complement the traditional role of project coordinators (Poirier et al., 2015), to support project managers with specific BIM competence (Lahdou & Zetterman, 2011), and to work alongside and together with design project managers (Bosch-Sijtsema et al., 2017). Recently, Mathews (2015) and Bosch-Sijtsema (2014) acknowledge that boundary spanning is an important skill set for BIM coordinators. The broad range of duties found to be required for jobs currently titled ‘BIM coordinator’ requires examinations.

## 4. BIM Skills

BIM skills, in the context of BIM and the construction industry in general, are difficult to term. BIM skills are the combination of construction knowledge with the integration of IT (Bosch-Sijtsema et al., 2019). The role of BIM coordinators does not solely rely on technical but also on non-technical skills (Liu et al., 2016). Very few reports contain definitions or specific examples of the type of skills or attributes required of BIM coordinators. For example, in the report ‘Built Environment 2050’ (BIM2050 Group, 2014):

‘... It seems that the inefficiency of the sector is due to the lack of soft skills and the lack of cultural integration of education and skills, such as teams, interdisciplinary, and how emotional intelligence is expressed’.

However, defining the skills needed by the industry will be required in the future to define non-technical skills in detail. While technical skills do not cause the inefficiency of BIM competencies, there’s a need for non-technical skills (Fransen et al., 2015) because there is a lack of non-technical skills and a lack of cultural integration of education and skills. These angles are often neglected in the existing BIM studies (Hodorog et al., 2019).

### 4.1 BIM Technical Skills

BIM technical skills are considered easily teachable to anyone with the right attitude and thus are viewed as an overlay to the other skill sets. Therefore, companies that focus on employing staff specifically for their BIM technical skills are immature BIM environments (Sumner & Slattery, 2010). However, the focus on BIM technical skills raises concerns about the flexibility of the resulting BIM environment and staff responsiveness to project challenges. Purely relying on BIM technical skills does not make a BIM coordinator able to perform their key daily tasks. Thus, including BIM technical skills on top of the other skills is considered a more robust approach to groom BIM coordinators (Sumner & Slattery, 2010). A few BIM technical skills are tabulated as follows:

**Table 2 - Example of BIM technical skills**

Author	BIM Technical Skills
Barison et al. (2011)	<ul style="list-style-type: none"> <li>• BIM Tools Skills</li> </ul>
Wei et al. (2014)	<ul style="list-style-type: none"> <li>• Site Utilisation Planning</li> <li>• Multi-trade 3D Coordination</li> <li>• Design Review</li> <li>• Multi-trade Modelling</li> </ul>
Murphy (2014)	<ul style="list-style-type: none"> <li>• Construction Technical Knowledge</li> </ul>

Rahman (2018) • BIM Tools Skills such as Revit, Navisworks

These skills are mentioned due to one of the roles of BIM coordinators, which is coordination (see Table 2). The BIM technical skill that is mentioned the most is the BIM Tools Skills. Some of the examples of the available BIM tools in the market are Autodesk, Tekla, Bentley, Synchro, Fuzor, and Vico. BIM coordinators coordinate, so they are unavoidably required to update some model data (Wei et al., 2014). Though they may not need to be an expert in BIM tools, they must know how to use and understand how the BIM tools work (Rahman, 2018). In addition, BIM coordinators must be equipped with construction technical knowledge (Murphy, 2014) to solve identified clashes by multi-trade coordination (Wei et al., 2014). Furthermore, they must be able to provide solutions and advice to BIM modellers for them to be able to lead the team. Therefore, a competent BIM coordinator must have practical skills on top of software skills.

#### 4.2 BIM Non-Technical Skills

Several authors include elements such as personality traits (Succar, Sher & Williams, 2013), emotional intelligence (Love et al., 2013), interpersonal skills (Sacks & Pikas, 2013), and leadership qualities (Maqbool et al., 2017) as BIM non-technical skills. Others describe non-technical skill descriptions as subject-specific and possibly use technical terms. The CIOB Competency Report (CIOB, 2013) includes ‘non-technical skills’ in the list of competencies required by the industry. However, there is no definition of which management skills fall into the category of non-technical skills or how they may differ (Matteson, Anderson & Boyden, 2016), for example, from technical or IT skills. ‘Communication and Negotiation Skills’ and ‘Leadership Skills’, both of which are commonly referred to as ‘non-technical skills’ are listed separately (MacDermott & Ortiz, 2017).

Succar, Sher, & Williams (2013) divide BIM competencies into abilities, activities, and outcomes. All three types of competencies are used by the various guidelines to define BIM specialist roles, with some focusing on actions and responsibilities, and others on abilities or skills requirements. MacDermott and Ortiz (2017) categorise BIM non-technical skills into two (2) categories, namely collaborative skills and leadership skills. Table 3 briefly describes the categories of BIM non-technical skills.

**Table 3 - BIM non-technical skills category (Macdermott & Ortiz, 2017)**

Categories	Description
Collaborative Skills	<ul style="list-style-type: none"> <li>• Accountability for own skillset</li> <li>• Ability to build and manage interdisciplinary teams</li> <li>• Ability to manage people of all hierarchy</li> <li>• Ability to organise and respect other’s skills and positions within a team</li> </ul>
Leadership Skills	<ul style="list-style-type: none"> <li>• Ability to enable others to act</li> <li>• Ability to inspire a shared vision</li> </ul>

Studies such as by Davies, Wilkinson & McMeel (2015; 2017) and Jacobsson & Merschbrock (2018) have investigated BIM non-tabulate skills. Amongst the research, the skill of communicating has been identified as the most important BIM non-technical skill, which, the majority of the past researchers have identified (Davies et al.,2015). As BIM implementation progressively shifts from adoption to adaptation, recent research has shown the importance of having standards in place, such as the BIM Process, BIM Standards, and BIM Workflow. Therefore, BIM coordinators need to have the capabilities and competencies to lead the project. Table 4 tabulated a few examples of BIM non-technical skills.

**Table 4 - Example of BIM non-technical skills**

Author	BIM Non-Technical Skills
Eadie et al. (2014)	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Collaboration</li> </ul>
Davies et al. (2015)	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Leadership</li> </ul>
Rahimi et al. (2016)	<ul style="list-style-type: none"> <li>• BIM Workflow</li> <li>• Communication</li> </ul>

Yakimi et al. (2017)	<ul style="list-style-type: none"> <li>• Teamwork</li> <li>• BIM Standard</li> <li>• Updated BIM Developments,</li> <li>• Leadership</li> </ul>
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Though limited, it shows the significance of this research theme to help define non-technical skills applicable to construction management in the transitioning industry, which the construction industry is severely in shortage (Papadonikolaki, Van Oel & Kagioglou, 2019). Table 5 tabulates a list of BIM non-technical skills based on the categories that are suitable and appropriate for the BIM coordinator.

**Table 5 - BIM non-technical skills**

Categories	BIM Non-Technical Skills
Collaborative	<ul style="list-style-type: none"> <li>• Interpersonal/Oral Communication</li> <li>• Written Communication</li> <li>• Teamwork</li> </ul>
Leadership	<ul style="list-style-type: none"> <li>• Decision Making</li> <li>• Management</li> <li>• Planning</li> </ul>

As one of the main roles of BIM coordinators is coordination (Wei et al., 2014), they are required to have good communication skills (Davies et al., 2015) to convey the issues and ensuring all parties can fully understand the overall matter. As BIM coordinators also act as a middle agent between multi parties, such as BIM managers, BIM modellers, consultants, and project teams, a BIM coordinator with only the skills of leadership would not be able to lead a team successfully. Thus, communication skills are one of the most important BIM non-technical skills, as summarised from multiple studies in Table 4.

## 5. Conclusion

Many new employments are created to accommodate the current trend in the construction industry. However, these jobs created are not based on the required BIM skills set. Worst, BIM coordinators lack clarity in the skills they needed to possess. Without a clear definition of the required BIM skills, an organisation will have difficulty measuring the competency of their BIM project team, and the education sector will be unable to prepare students with the right skills. Apart from that, most of the BIM coordinators face challenges such as difficulty suggesting solutions to solve construction issues due to inexperienced workers. Some also have communication breakdowns with team members. All of these happen due to unclear definitions of the roles and BIM skills required. This paper reviewed the related literature to identify the skills needed for BIM coordinators. Table 6 lists the two main skills for both technical and non-technical BIM skills required in a competent BIM coordinator.

**Table 6 - BIM skills**

BIM - Technical Skills	BIM Non-Technical Skills
<ul style="list-style-type: none"> <li>• BIM Tools Skills</li> <li>• Multi-trade Coordination</li> </ul>	<ul style="list-style-type: none"> <li>• Communication Skills</li> <li>• Collaboration</li> </ul>

In conclusion, further research is required to fully identify the BIM skills required as a BIM coordinator. It is significant to study the required BIM skills to ensure the BIM project team is capable of implementing BIM.

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