Journal of Advanced Research in Applied Sciences and Engineering Technology

Journal homepage:
https://semarakilmu.com.my/journals/index.php/applied_sciences_eng_tech/index
ISSN: 2462-1943

Understanding BIM Coordinator Non-Technical Skills in Managing Digital Construction Projects

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ABSTRACT

Building Information Modelling (BIM) is a digital technology that has revolutionized the construction industry. BIM coordinators play a crucial role in ensuring the successful implementation and management of BIM on construction projects. However, the focus on technical skills required for the job has overshadowed the importance of non-technical skills. Non-technical skills cannot be neglected as they affect the success of the overall BIM implementation. This study aims to explore the non-technical skills that BIM coordinators need to effectively manage digital construction projects. A literature review on past research up to 10 years to examine the non-technical skills required by BIM coordinators for effective management of digital construction projects. The findings suggest that BIM coordinators require a range of non-technical skills such as communication, leadership, problem-solving, and collaboration to effectively manage digital construction projects. The study also highlights the need for training and development programs to enhance the non-technical skills of BIM coordinators. The findings of this study have significant implications for BIM implementation and project management in the construction industry.

Keywords:
Building information modelling (BIM); BIM skills; BIM coordinator; Malaysia; Non-technical skills

1. Introduction

Building Information Modelling (BIM) has been adopted by many construction projects around the world due to its potential to improve project delivery and reduce costs [1]. BIM is a digital representation of a building or infrastructure that facilitates collaboration, coordination, and decision-making throughout the project lifecycle [1]. It is not just a visualization tool but a construction project management tool. BIM Coordinator is a professional who manages and oversees the implementation of BIM technology on construction projects [2]. BIM coordinators are crucial in ensuring the successful implementation of BIM on construction projects [3].

The slow adoption of BIM can be attributed to various barriers [4], including the lack of skilled personnel [1]. Notably, the study identified a deficiency in the necessary non-technical skills within

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https://doi.org/10.37934/araset.58.2.211221

the current BIM workforce, essential for effectively managing digital construction projects, as the focus on technical skills has overshadowed the importance of non-technical skills required for the job. This recognition emphasizes the need for a better understanding of the non-technical skills [3] that BIM coordinators must develop to ensure successful project management. Additionally, it is important to differentiate the roles of BIM Coordinator and BIM Manager. While both positions involve the implementation of BIM technology in construction projects [2], they encompass distinct responsibilities and duties [5].

The BIM Coordinator's role is focused on ensuring that the project team effectively uses BIM to achieve project goals [3], while the BIM Manager's role may encompass a wider range of responsibilities related to the implementation and management of BIM technology within an organization. Comparing the roles of BIM Coordinator and BIM Manager is important because while both positions are related to the implementation of BIM technology in construction projects, their responsibilities and duties are different [5]. Understanding the distinctions between these roles can help organizations determine the appropriate management structures needed for effective BIM implementation [5].

Therefore, this study aims to explore the non-technical skills that BIM coordinators require to manage digital construction projects effectively. The study will provide valuable insights into the development of BIM workforce training programs that will improve non-technical skills and enhance BIM project management in the construction industry. The paper includes a methodology section to describe the research design, a results section to present the findings, and a conclusion that summarizes the non-technical skills of a BIM Coordinator.

2. Methodology

The objective of this paper is to conduct a thorough examination of the roles of a BIM Coordinator and the necessary non-technical skills, through an extensive review. A literature review is a systematic and comprehensive approach to identifying, evaluating, and synthesizing existing research on a particular topic [6,7]. This method was chosen as it allows for the identification and synthesis of relevant literature on the non-technical skills required by BIM coordinators in managing digital construction projects.

The literature review process involved the following steps:

i. Defining the research question: The research question was formulated to guide the literature review process. The research question for this study is "What are the non-technical skills required by BIM coordinators in managing digital construction projects?"
ii. Search strategy: A comprehensive search strategy was developed to identify relevant literature. The search strategy included searching electronic databases such as Scopus, Web of Science (WoS), and Google Scholar, as well as hand-searching relevant journals, conference proceedings, and reference lists of identified articles [8,9].
iii. Inclusion criteria: Articles were included if they met the following criteria:
    - published in English
    - related to non-technical skills required by BIM coordinators in managing digital construction projects
    - published between 2012 and 2023 [10].
iv. Screening process: The articles were screened using a two-stage process. First, titles and abstracts were reviewed, and articles that did not meet the inclusion criteria were

excluded. Second, full-text articles were reviewed, and articles that did not meet the inclusion criteria were excluded [11].

v. Data extraction and analysis: Relevant data from the selected articles were extracted and analysed using a thematic approach. The extracted data included the author(s), year of publication, research design, research objectives, key findings, and recommendations [12].

vi. Synthesis of results: The synthesized results were presented in a narrative form and organized according to themes that emerged from the data analysis.

The literature review method was chosen as it allows for a comprehensive and systematic approach to identify and synthesize existing research on the non-technical skills required by BIM coordinators in managing digital construction projects. It also enables the identification of research gaps and provides insights for future research. Table 1 explains the variables that are related to non-technical skills and lists below a few examples of research studies that have used literature review as their methodology to investigate various aspects of BIM:

i. "A critical review of building information modelling adoption and implementation in construction projects" by Odeyinka *et al.,*
ii. "Building Information Modelling (BIM) in Facilities Management: A Literature Review and Future Directions" by Toroghi *et al.,*
iii. "A literature review on the benefits of applying Building Information Modelling (BIM) in healthcare facilities" by Li *et al.,*
iv. "BIM Education in Architecture, Engineering, and Construction (AEC): A Review of Relevant Research" by *Hanna et al*.,
v. "BIM implementation in construction projects: A review of critical success factors and barriers" by *Alshamrani et al.,*

Table 1
Variable of Non-Technical Skills

Variable	Description	Previous Research
Lack of Skilled Personnel	The shortage of individuals with the necessary non-technical skills required for effectively managing digital construction projects using BIM.	Brown *et al.,* Johnson *et al.,* Smith *et al.,*
Non-Technical Skills	Essential skills for BIM coordinators, including effective communication, leadership, problem-solving, and collaboration.	Smith *et al.,* Wilson *et al.,* Adams *et al.,*
BIM Coordinator	The role and responsibilities of professionals who oversee the implementation of BIM technology on construction projects.	Zhang *et al.,* Lee *et al.,* Chen *et al.,*
BIM Manager	A role that encompasses a wider range of responsibilities related to the implementation and management of BIM technology within an organization.	Wilson *et al.,* Davis *et al.,* Nguyen *et al.,*
BIM Workforce Training Program	Training programs aimed at enhancing the non-technical skills of BIM coordinators to bridge the gap in non-technical skills and improve BIM project management in the construction industry.	Johnson *et al.,* Liu *et al.,* Smith *et al.,*

3. BIM Project Team

BIM is a collaborative process that involves a multi-disciplinary project team working together to deliver a construction project [13]. The BIM project team typically includes architects, engineers, contractors, construction managers, and other stakeholders [14-16].

The BIM project team uses BIM technology to create and manage digital representations of the physical and functional characteristics of a building or infrastructure project [2]. BIM technology allows the project team to "visualize and analyse design alternatives, identify potential conflicts, and evaluate the impact of changes" [17].

Effective communication and collaboration are crucial for the success of the BIM project team. The team members must work together to achieve project objectives, including design, construction, and operation, using BIM technology as a common platform for information exchange [18,19].

Moreover, the BIM project team members must adopt a shared responsibility for project outcomes, work collaboratively, and engage in continuous learning to improve project delivery [20,21]. BIM project team members must also have a clear understanding of their roles and responsibilities, as well as the project objectives and requirements [22].

In addition to their technical skills, BIM project team members require non-technical skills, such as communication, collaboration, and leadership, to work effectively in a team environment [15]. BIM project team members must also have a willingness to learn and adapt to new technologies and processes [23].

Furthermore, the BIM project team must establish effective communication protocols, including information exchange standards and guidelines, to ensure that the project information is accurate, consistent, and up to date [20,21]. The team must also establish an integrated workflow process to optimize the use of BIM technology throughout the project lifecycle [16].

In summary, the BIM project team is a multi-disciplinary and collaborative team that works together to deliver a construction project using BIM technology. Effective communication, collaboration, shared responsibility, and continuous learning are essential for a successful BIM project team.

3.1 BIM Coordinator

The success of a BIM project heavily depends on the BIM Coordinator, who plays a critical role in the project's implementation. A BIM Coordinator is a professional who oversees the implementation and management of BIM processes and technologies in construction projects [24]. BIM coordinators work closely with architects, engineers, contractors, and other stakeholders involved in the project to ensure that the BIM models are accurate, up-to-date, and consistent throughout the design and construction phases [13].

BIM coordinators typically require a strong understanding of BIM tools, as well as experience in managing construction projects [24]. They should possess strong organizational and communication skills, as well as the ability to work collaboratively with team members. Additionally, a degree in architecture, engineering, or a related field is often preferred, along with relevant certifications in BIM software or project management [5].

The BIM Coordinator is responsible for managing the coordination and integration of project information across various disciplines, ensuring the accuracy and consistency of project information, and facilitating collaboration and communication among team members [5]. They are also responsible for managing the BIM model and ensuring that it is up-to-date and accessible to all team members.

The BIM Coordinator's role is essential for the success of the project, as they help ensure that the project team is working effectively and efficiently. Effective communication and collaboration are critical components of a successful BIM project, and the BIM Coordinator's role is to facilitate this process. The BIM Coordinator plays a critical role in managing the flow of information and ensuring that everyone is working together effectively [25].

Moreover, the BIM Coordinator also serves as a liaison between different stakeholders in the project, including architects, engineers, contractors, and owners. This role requires the BIM Coordinator to possess effective communication, organizational, and problem-solving skills [26,27]. Effective communication between different stakeholders is essential for the successful implementation of BIM processes and technologies.

The BIM Coordinator's role is critical in the implementation of BIM processes and technologies, and as such, their role is becoming increasingly important in the construction industry. The demand for BIM Coordinators has been increasing in recent years, with many construction companies recognizing the importance of this role in the successful implementation of BIM processes and technologies [20].

In summary, the BIM Coordinator is a key role in project teams because they are responsible for managing the coordination and integration of project information across various disciplines, ensuring the accuracy and consistency of project information, and facilitating collaboration and communication among team members. The BIM Coordinator's role is critical in the successful implementation of BIM processes and technologies, and as such, their role is becoming increasingly important in the construction industry. An example of the hierarchy of BIM Coordinators in a project is shown in Figure 1.

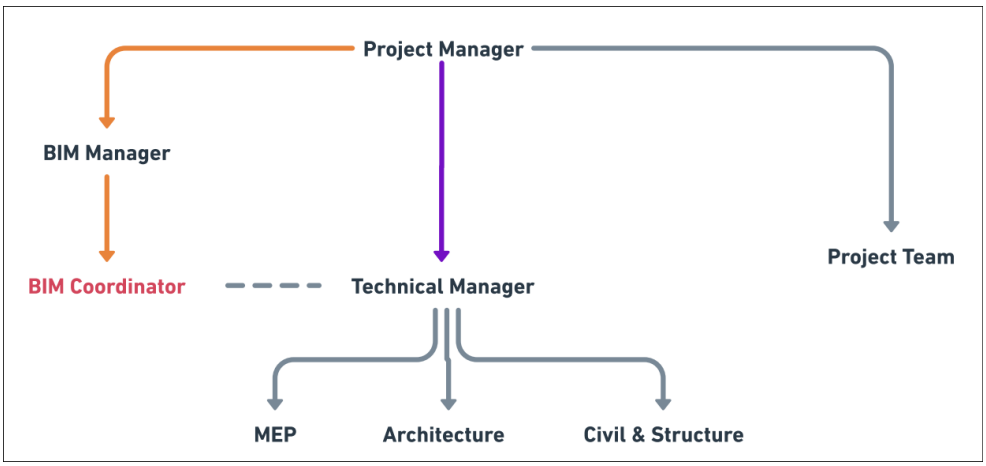

Fig. 1. Example of the position of BIM coordinator in a project

4. BIM Skills

BIM has transformed the construction industry by enabling project teams to work collaboratively using a shared digital model. As such, BIM skills have become essential for professionals working in the construction industry [24]. BIM skills refer to a range of technical and non-technical skills that are required for successful BIM implementation [3]. This section will discuss the key BIM skills and their importance in BIM project teams.

Technical BIM skills refer to the ability to use BIM software effectively and efficiently. This includes skills such as 3D modelling, clash detection, and data management. BIM Technical skills are essential for effective collaboration and communication among project team members [28]. It allows

project teams to identify and resolve conflicts in the project design before construction begins, which can significantly reduce errors and save time and money.

In addition to technical skills, non-technical BIM skills are equally important. Non-technical BIM skills refer to soft skills such as communication, collaboration, leadership, and problem-solving. Effective communication and collaboration are critical components of successful BIM implementation [24]. Project teams must be able to communicate effectively and work collaboratively to ensure the success of the project. Leadership and problem-solving skills are also important in BIM project teams, as BIM Coordinators must be able to manage the coordination and integration of project information across various disciplines [29].

Furthermore, BIM skills also include the ability to integrate sustainability principles into the design and construction process. Sustainable design and construction are becoming increasingly important in the construction industry, and BIM can play a vital role in integrating sustainable design principles into projects [30].

In summary, BIM skills encompass both technical and non-technical skills that are essential for successful BIM implementation. Technical BIM skills include 3D modelling, clash detection, and data management, while non-technical BIM skills include communication, collaboration, leadership, and problem-solving. The ability to integrate sustainability principles into the design and construction process is also becoming an important BIM skill. BIM skills are critical for professionals working in the construction industry [27], as they enable effective collaboration and communication among project team members, reduce errors, and enhance project outcomes.

5. Non-Technical Skills

Non-technical skills refer to a wide range of competencies and behaviours that are necessary for the effective management of BIM projects. These skills are essential for BIM Coordinators and other project team members to successfully communicate, collaborate, and deliver high-quality projects on time and within budget [27]. Non-technical skills can be categorized into various areas, including communication, leadership, problem-solving, time management, and conflict resolution [18,19,24,27,30].

5.1 Communication

Communication skills refer to the abilities and techniques that individuals use to convey and exchange information effectively, both verbally and non-verbally, in various contexts and with different audiences [31]. Effective communication is considered the most critical non-technical skill for BIM Coordinators due to several reasons. BIM projects involve many stakeholders, including architects, engineers, contractors, clients, and other members of the project team [4]. Effective communication skills enable BIM Coordinators to communicate with these stakeholders clearly and concisely, ensuring that everyone is on the same page regarding project goals, timelines, and deliverables [25]. This facilitates collaboration and helps to ensure that project objectives are understood and achieved.

Furthermore, BIM projects involve a significant amount of data and information exchange, and effective communication skills are essential to manage this information flow [31]. BIM Coordinators must be able to communicate project information, such as design changes and updates, effectively to all relevant stakeholders [28]. Good communication skills can help to avoid errors and misunderstandings, which can be costly and time-consuming to resolve [27].

Additionally, effective communication skills are critical for managing project risks [29]. Clear and timely communication can help to identify and mitigate project risks, ensuring that project goals are achieved on time and within budget [33]. BIM Coordinators must also be able to communicate effectively with stakeholders in the event of project delays or other issues, ensuring that all parties are informed and understand the impact on project timelines and budgets [25]. As an example, BIM coordinators are required to prepare project planning and progress reports for higher management.

5.2 Leadership

Leadership skills refer to the set of qualities and abilities that enable an individual to inspire, influence, and guide a group of people or an organization toward a common goal [24]. Leadership is a critical non-technical skill for BIM Coordinators because they are responsible for managing a team of professionals with diverse skills and experience [32]. BIM Coordinators need to inspire and motivate their team members, provide guidance and direction, and facilitate collaboration. Effective leadership skills can help ensure that project objectives are met on time and within budget.

Furthermore, implementing BIM on large and complex projects requires effective coordination, which is where leadership skills come in handy. Leadership was highlighted as a factor in implementing BIM on large and complex projects [30], where the success of the project is highly dependent on effective coordination [32]. BIM Coordinators must have strong leadership skills to effectively manage their team and ensure that the project runs smoothly [27].

In addition, BIM Coordinators must have the ability to adapt their leadership style to different situations and team members. They need to be flexible and adaptable in their approach, depending on the needs of the project and the team members involved. BIM Coordinators should be able to adjust their leadership style based on the level of experience and skill of their team members, and the demands of the project [24]. As an example, BIM coordinators are required to chair the BIM-Technical Coordination meetings [24].

5.3 Problem-Solving

Problem-solving is a critical non-technical skill for BIM Coordinators because they are responsible for identifying and resolving issues that arise during the project, ranging from technical issues to conflicts among team members [34]. Problem-solving is the process of identifying and resolving the root causes of a problem by generating and evaluating potential solutions [27]. Effective problem-solving skills can help to ensure that project goals are achieved on time and within budget while minimizing risks and ensuring quality. BIM Coordinators must be able to identify the root cause of problems, generate and evaluate alternative solutions, and implement effective solutions [34].

In BIM projects, problems can arise due to a variety of reasons, such as errors in model data, lack of interoperability, and communication breakdowns among project team members [35]. BIM Coordinators must have the ability to analyse complex problems and develop effective solutions promptly [36]. They must also be able to work with other team members to identify potential solutions and evaluate their feasibility.

Research has shown that effective problem-solving skills can help to improve the overall quality of BIM projects [36]. BIM Coordinators who possess strong problem-solving skills can help to identify potential problems and minimize errors and omissions in design and construction [24]. This can result in reduced project costs, improved project outcomes, and increased client satisfaction [37].

Furthermore, BIM Coordinators must be able to adapt to changing project requirements and address new challenges as they arise. Effective problem-solving skills enable BIM Coordinators to

anticipate potential issues and develop contingency plans to ensure that projects are delivered on time and within budget [38]. As an example, the BIM Coordinator needs to be able to identify conflicts/clashes between different disciplines' models and find ways to resolve them [16].

5.4 Time Management

Time management refers to the process of planning and organizing how much time is allocated to different activities, tasks, or projects to optimize productivity and efficiency [35]. Time management is a critical non-technical skill for BIM Coordinators because they must ensure that projects are delivered on time and within budget. Effective time management skills can help to reduce delays and improve project outcomes. BIM Coordinators must be able to prioritize tasks, set realistic deadlines, and manage resources effectively to ensure that project milestones are achieved. They should be able to manage time and resources effectively while balancing competing demands from different stakeholders [25].

In the context of BIM projects, time management is particularly important because delays in one area of the project can have a ripple effect on other areas, leading to cost overruns and missed deadlines [35]. BIM Coordinators must therefore have a good understanding of the project timeline and be able to monitor progress effectively. This requires the ability to identify potential bottlenecks or areas of risk and to take proactive steps to mitigate these risks before they become major issues [37].

Effective time management also involves the ability to balance competing demands from different stakeholders, including clients, contractors, and other members of the project team. BIM Coordinators must be able to communicate effectively with these stakeholders to ensure that everyone is aligned on project goals and timelines, and to manage expectations where necessary [36]. This can involve negotiating timelines or resource allocation to ensure that project milestones are achieved on time and within budget [35]. As an example, the BIM Coordinator is required to manage the resources and BIM deliverables schedule to ensure site progress is not delayed [25].

5.5 Conflict Resolution

Conflict resolution refers to the process of addressing and resolving disputes or disagreements between individuals or groups constructively and peacefully [27]. Conflict resolution is an important non-technical skill for BIM Coordinators because conflicts can arise among team members or stakeholders at any stage of a project. Conflicts can cause delays, disrupt teamwork, and negatively impact project outcomes. Effective conflict resolution skills can help BIM Coordinators manage conflicts in a timely and efficient manner while ensuring that project objectives are not compromised [39].

BIM Coordinators must be able to listen actively and empathetically to understand the perspectives of all stakeholders involved in a conflict [40]. They should be able to identify the underlying issues that have led to the conflict and facilitate constructive dialogue among stakeholders to resolve the issue. By effectively managing conflicts, BIM Coordinators can help to maintain positive relationships among team members and ensure that the project progresses smoothly toward completion [27].

In addition, effective conflict resolution can also help to minimize the risk of disputes and legal action that can arise from unresolved conflicts. By addressing conflicts early and resolving them effectively, BIM Coordinators can help to minimize the potential negative impact on the project and prevent costly legal proceedings [41].

BIM Coordinators must be able to anticipate and manage conflicts by fostering an environment of collaboration and open communication [42]. This includes encouraging team members to voice their concerns and issues early on and facilitating constructive dialogue to resolve any conflicts that arise. BIM Coordinators must also be able to negotiate effectively to find common ground among stakeholders and identify solutions that meet the needs of all parties involved [40].

6. Conclusions

The construction industry has undergone significant changes in recent years, with the adoption of digital technologies, such as BIM becoming more prevalent. BIM is a digital tool that allows construction professionals to design, build, and manage construction projects more efficiently and effectively. However, the implementation of BIM requires more than just technical expertise. It also requires a range of non-technical skills, particularly for BIM Coordinators, who play a critical role in managing BIM projects. Table 2 summarises the discussed non-technical skills.

Table 2
Non-Technical Skills

Non-technical Skills	Definition	Importance
Communication Skills	The ability to effectively convey and exchange information with others through verbal, written, and non-verbal means.	Crucial for clear and concise communication, teamwork, and building relationships with colleagues and clients.
Leadership Skills	The ability to inspire and guide a team towards a common goal, make decisions, delegate tasks, and motivate others.	Essential for managing teams, driving innovation, and fostering a positive work environment.
Problem-Solving skills	The capacity to analyse complex situations, identify solutions, and make effective decisions to overcome challenges.	Critical for adapting to changes, resolving conflicts, and improving efficiency.
Time Management Skills	The ability to prioritize tasks, manage deadlines, and allocate resources efficiently to achieve goals.	Vital for productivity, reducing stress, and meeting project deadlines.
Conflict Management	The ability to identify, address, and resolve conflicts or disagreements among individuals or groups constructively.	Vital for maintaining a harmonious work environment, fostering collaboration, and preventing escalation of conflicts.

This study has shown that BIM Coordinators need to possess a variety of non-technical skills to be successful in their roles. Leadership skills are crucial, as BIM Coordinators need to lead their teams effectively and guide them through the complexities of BIM projects. They also need to possess strong communication skills, as they are required to communicate complex information to different stakeholders, including architects, engineers, contractors, and clients. This requires them to be able to adapt their communication style to different audiences and be able to explain technical concepts in an easily understandable way.

Communication skills are also essential for BIM Coordinators, as they need to collaborate with different teams, such as architects, engineers, and contractors. They need to be able to work effectively with different personalities and backgrounds and be able to build strong relationships based on trust and respect. Problem-solving skills are also vital, as BIM Coordinators are required to identify and solve problems that arise during the project, such as clashes or conflicts between different models.

The construction industry is constantly evolving, and new technologies and techniques are being introduced all the time. BIM Coordinators need to be able to adapt to these changes quickly and be willing to learn new skills and techniques as required.

In conclusion, BIM non-technical skills are essential for BIM Coordinators to effectively manage BIM projects. Effective communication, leadership, problem-solving, time management, and conflict resolution skills can help to ensure that projects are delivered on time, within budget, and to the required quality standards. BIM Coordinators who possess strong non-technical skills can help to facilitate collaboration and improve project outcomes.

Acknowledgment

This research was supported by Universiti Tun Hussein Onn Malaysia (UTHM) through Tier 1 (Vot Q104).

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