A Study on The Readiness of Licensed Land Surveyors in The Implementation of Building Information Modelling (BIM) In Construction Projects

Norlydah binti Othman Latpi[1], Azrina binti Zolkifli[2], Ahmad Yusof bin Sahdan[3]
[1,2,3] Department of Civil Engineering, Politeknik Merlimau, Melaka.
*Corresponding author's email: norlydah@gmail.com

Abstract: The integration of Building Information Modelling (BIM) into construction projects has transformed the industry by improving efficiency, accuracy, and collaboration across disciplines. However, the readiness of Licensed Land Surveyors (LLSs) to adopt and implement BIM remains uncertain, particularly in developing countries such as Malaysia. This study aims to assess the level of readiness among LLSs in terms of knowledge, technical skills, technological resources, and industry involvement in BIM-related workflows. A quantitative research approach was adopted, using a structured questionnaire distributed to practicing LLSs registered with the Land Surveyors Board of Malaysia (LJT). The collected data were analyzed using descriptive statistics to determine the factors influencing BIM readiness. The findings reveal that while there is a general awareness of BIM and its importance in the construction sector, many LLSs face challenges related to insufficient training, lack of standardized BIM guidelines, and limited access to BIM-compatible technologies. This research underscores the need for targeted training programs, institutional support, and policy development to enhance the role of LLSs in BIM implementation. The outcomes of this study provide insights for government agencies, educational institutions, and professional bodies in planning strategic interventions to improve BIM adoption among land surveyors.

Keywords: *Building Information Modelling (BIM), Licensed Land Surveyors (LLS), construction projects, BIM readiness, engineering surveying.*

1.0 INTRODUCTION

Building Information Modelling (BIM) is a technology used for the management, planning, and construction of facilities through the generation of digital images of structures (CIDB, 2014). Generally, BIM is defined as a digital model that functions as a platform for generating construction design concepts from the early stages through to completion. Architectural design and BIM software are common computer-aided design tools in the architecture and construction industry. Although BIM originated in architecture, nearly all infrastructure projects, including site work, subdivisions, bridges, highways, and other typical tasks performed by land surveyors, benefit from the foundational ideas of working with accurate 3D digital models (Lam, M.K. & Tang, D. C., 2014).

Building Information Modelling (BIM) has emerged as a transformative tool in the construction industry, revolutionizing how information is managed, visualized, and shared among stakeholders. While BIM adoption has been widely studied among architects, engineers, and contractors but limited attention has been given to the role and readiness of licensed land surveyors in this digital transition.

Land surveyors are responsible for managing topographic geometric information for construction sites and facilities, also play a role in 3D spatial data management and coordination (Lam, M.K. & Tang, D. C., 2014). There has been a significant rise in the use of 3D scanners and BIM technologies in the land surveying sector (Tzedaki & Kamara, 2013). According to Eastman et al. (2011), BIM supports site validation and positioning using technologies such as RFID, laser scanning, GPS, and automated machinery. This allows discrepancies in construction to be identified and corrected using BIM model displays.

This technology, known as LiDAR, provides an accurate and efficient method for collecting three-dimensional (3D) information about existing structures in the form of a point cloud. For LLSs, the uses

of LiDAR technology is not new in the land surveying field; LiDAR scanners are used to create detailed 3D maps and models of environments by measuring distances using laser light. In a construction project, LiDAR is used to create digital twins of buildings and infrastructure, track construction progress, and perform site analysis. It helps in planning, monitoring, and managing construction projects efficiently.

Figure 1.0: The role of Licensed Land Surveyors from the early stage to completion in a construction project

From Figure 1.0 above, LLSs play a very significant role of LLSs involved from the early stage of construction until the end of completion and delivery of vacant possession. However, as for LLSs familiar with the use of LiDAR technology, there is are small number of LLSs that have the equipment offered serviced for Scan to BIM as adoption in Figure 1.1.

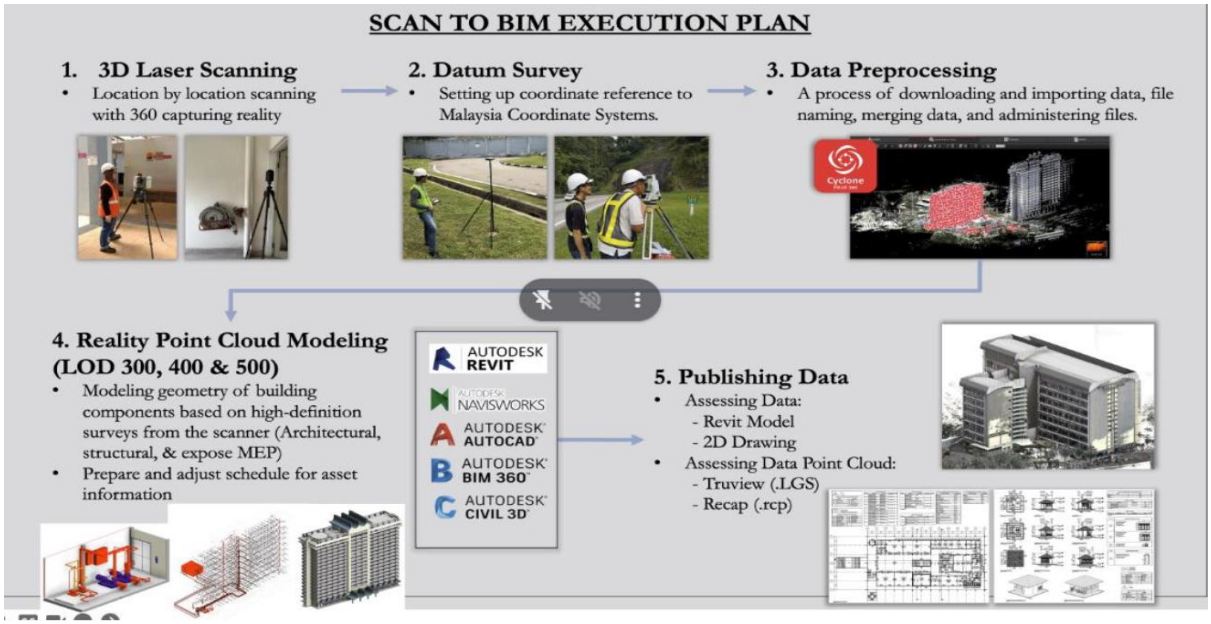


Figure 1.1: Scan to BIM Execution Plan process adopted by LLSs

After the process of Scan to BIM published, 4D visualization schedules can be integrated with Gantt chart visualization techniques using BIM (Wang & Chien, 2014). Eastman (2011) explained that BIM models can represent whether the building design is aligned with the construction. Amin & Abanda (2019) viewed complex information management as a core BIM component throughout the construction process.

BIM also helps identify design flaws early in the process to minimize rework and errors. When two elements occupy the same space, conflicts occur, requiring design, geometry, and schedule modifications (Savitri, 2020). Software like Tekla BIM sight, Navisworks, and Bentley Navigator is commonly used for clash detection during the construction phase. BIM allows virtual site management by monitoring worker activity, tracking materials and equipment, and maintaining strong supplier relationships (Li & Yang, 2017). This results in more efficient and organized management of assets and raw materials. The benefits of BIM include reduced design clashes, lower project risks, less unnecessary documentation, waste minimization, increased productivity, reduced costs, and higher profits through better products and services (Lau, 2018).

However, in Malaysia, BIM is mostly applied during design phases and is underutilized in construction stages (Memon, 2021; Othman, 2021). This limited application contributes to low BIM adoption levels nationwide. One challenge with BIM is the need to upgrade existing systems, which can be costly. For example, increasing memory capacity (Zahrizan, 2013). These high implementation costs are a burden, especially for small firms.

A lack of comprehensive guidelines can confuse BIM users (Zahrizan, 2013). Moreover, when companies develop their own BIM guidelines, incompatibility with standard models can occur (Teng, 2018). Another barrier is the lack of training and comprehensive education on BIM applications (Wong & Gray, 2019), which limits BIM use. Productivity may also decline during training phases (Tan, 2019). Additionally, many professionals lack sufficient knowledge of BIM (Yan & Kah, 2018) and continue to use traditional methods (Othman, 2021). In 2007, the Public Works Department (JKR) began introducing BIM to improve construction practices (Kasim, 2017), marking the beginning of BIM development in Malaysia and effective July 2025 according to Circular PK1.15 regarding the implementation of BIM will begin, especially on government projects.

Efforts to increase BIM usage include:

- Offering basic BIM training,
- Involving experienced industry players to share best practices (Lee, 2019),
- Encouraging internal training programs in BIM-capable companies (Pena, 2011),
- Incorporating BIM into higher education to produce skilled graduates (Sinoh, 2020),
- Developing Malaysian-specific BIM-GIS guidelines for standardization (Teng, 2018).

According to Kementerian Kerja Raya Malaysia. (2023) official website as main specialization mentor under Cawangan Perancangan Aset Bersepadu (CPAB), PEJUTA (Malaysian Licensed Land Surveyors Association), paid a courtesy visit and has expressed readiness to collaborate with JKR to develop BIM-GIS standards, acknowledging the entry of 3D digitalization into surveying. The government should mandate BIM adoption for both large and small construction projects, as collaboration among clients, contractors, professionals, and government is critical to achieving this goal (Smith, 2014). Currently, BIM is not widely used due to its high cost and project-specific nature, being enforced only for projects worth RM10 million and above. Astro Awani. (2022, Oktober 15). BIM costs can reach 10% of the total construction budget *(Sr. Nur Zurairah Binti Abdul Halim, personal communication, 2024).*

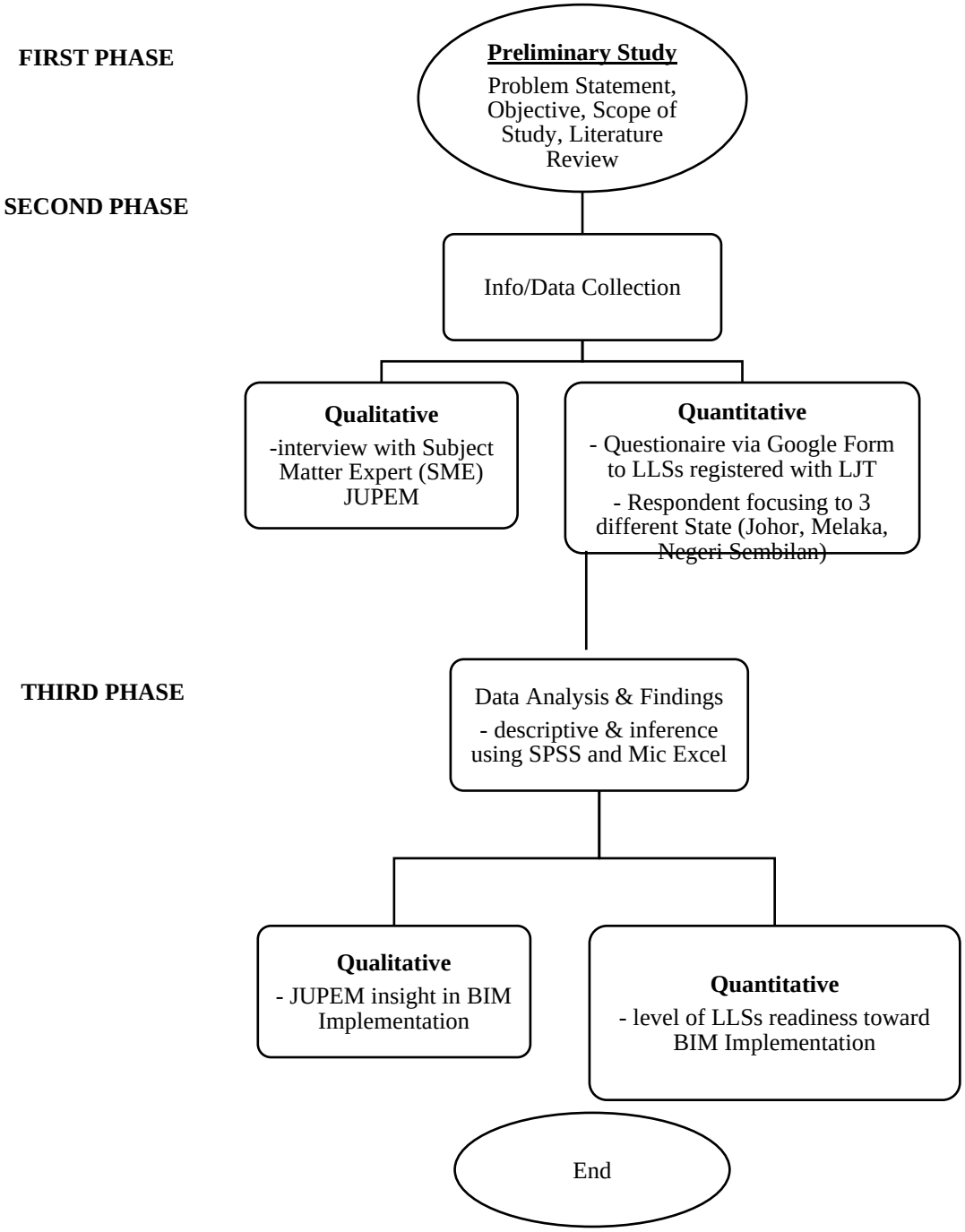
JUPEM's Role in BIM

JUPEM's role focuses on setting GIS-BIM standards, particularly in managing the Level of Detail (LoD) of 3D BIM models. Although JUPEM does not regulate BIM, it can establish Terms of Reference (TOR) requiring BIM-experienced Licensed Land Surveyors for specific projects. Ultimately, project developers determine BIM use. JUPEM serves more as a standards coordinator than an enforcer, referring to the 2021 Geomatics Surveying Regulation and GIS-BIM standards when applicable *(Sr. Nur Zurairah Binti Abdul Halim, personal communication, 2024).*

BIM offers improved project monitoring and can expand the scope of surveying and mapping by integrating built environment elements. BIM models require horizontal and vertical control, spatial data, and more. Currently, there is a lack of integration between AEC professionals and Licensed Land Surveyors due to differing information storage systems. However, data exchange is beginning to bridge this gap *(Sr. Nur Zurairah Binti Abdul Halim, personal communication, 2024).* Ultimately, increasing BIM adoption depends on broad involvement and awareness. The key to success is raising awareness and encouraging participation from all stakeholders.

2.0 METHODOLOGY

This study employs both qualitative and quantitative concepts, which provide an approach to the use of BIM and highlight the importance of respondents in the analysis. The methodology uses interviews and surveys as the primary data collection methods. A summary of this research methodology is shown in the Figure below:



Flow Chart 2.0: Summary of Research Methodology

3.0 DATA ANALYSIS AND FINDINGS

3.1 Interview Findings: BIM Implementation Insights from JUPEM

The qualitative method involved a semi-structured interview with Sr. Nur Zurairah Binti Abdul Halim, Subject Matter Expert (SME) in Cadastral officer specialized in Terrestrial Data Acquisition & 3D Modelling from the Department of Survey and Mapping Malaysia (JUPEM). The purpose was to

explore JUPEM's perspective on Building Information Modelling (BIM) implementation, its challenges, and its impact on Licensed Land Surveyors.

3.1.1 Popularity and Cost of BIM

BIM adoption in Malaysia is currently limited due to its high cost and conditional enforcement. According to the respondent:

"BIM is not popular because it has specific characteristics that must be applied to a project, and these characteristics are not enforced unless the project is valued above RM100 million. This is due to the high costs associated with BIM, which accounts for about 10% of the total construction cost." (Sr. Nur Zurairah Binti Abdul Halim, personal communication, 2024)

This suggests that cost is a major barrier to widespread BIM adoption, particularly for small-scale or private sector projects.

3.1.2 JUPEM's Role in BIM Implementation

JUPEM plays a **non-regulatory but strategic role** in BIM adoption, primarily focusing on **standard coordination** rather than enforcement. The respondent explained:

"JUPEM is responsible for setting the GIS-BIM standards, as the 3D BIM model contains various attribute data with different Levels of Detail (LoD). JUPEM defines the standards to integrate BIM models with GIS elements."

JUPEM's responsibility lies in ensuring consistency and interoperability between spatial data and BIM models, particularly in terms of Level of Detail (LoD) and attribute management.

3.1.3 BIM Usage and Enforcement Among Licensed Land Surveyors

While JUPEM does not mandate BIM use, it influences project specifications through **Terms of Reference (TOR)** when BIM expertise is required. However, the final decision lies with the project developer:

"JUPEM does not currently regulate BIM usage, but it can set Terms of Reference (TOR) for construction projects that require BIM expertise. However, the use of BIM in a project depends on the developer."

Thus, enforcement of BIM is indirect and discretionary, based on project requirements and stakeholder initiative.

3.1.4 Benefits of BIM for JUPEM and Surveyors

BIM offers multiple benefits for spatial professionals and JUPEM. These include:

"Better project monitoring and the expansion of the surveying and mapping scope, such as integrating horizontal and vertical control, spatial data, and more."

This illustrates how BIM enhances the **accuracy, scope, and coordination** of geospatial data in construction workflows.

3.1.5 Challenges in BIM Integration

One significant barrier to BIM adoption is the **lack of integration** between **AEC professionals and Licensed Land Surveyors**. The interviewee emphasized:

"There is a lack of integration between the Architecture, Engineering, and Construction (AEC) teams and Licensed Land Surveyors. The difference in information storage between these parties makes it difficult to merge the data, but integration is being attempted through data exchange."
This highlights the need for standardized data structures and interoperable platforms to facilitate smooth collaboration.

3.1.6 Strategies to Improve BIM Adoption

Finally, JUPEM recognizes the importance of **awareness and stakeholder involvement**:
"JUPEM's strategy to enhance BIM adoption includes raising awareness and involving various parties in the process."
This suggests that outreach, training, and policy alignment are essential to increasing BIM readiness across the surveying profession.

3.2 Quantitative Findings: Readiness of LLS in The Implementation of BIM

Once the information has been collected either directly or indirectly, several analyses are needed to assess the results and effectiveness of the study. Based on the data collection phases, which were carried out through surveys from the involved agencies, the information analysis was organized. The survey is targeted a Licensed Land Surveyors from the Southern Region, involving three states, Negeri Sembilan, Melaka, and Johor. Therefore, the survey data were analysed using the Statistical Package for the Social Sciences (SPSS) to obtain descriptive statistics, which were shown in percentages and frequencies. The survey is divided into three sections, as shown in Table 4.2 below.

Table 3.2: Questionnaire Content

Section	Content
A	Demographic information (respondent's state, agency, position, services offered)
B	Knowledge of BIM among Licensed Land Surveyors in Negeri Sembilan, Melaka, and Johor
C	Readiness for BIM implementation among Licensed Land Surveyors in Melaka, Johor, and Negeri Sembilan

The survey helps identify the number of respondents, their level of preparation and knowledge regarding BIM, and the problems encountered. By conducting this survey, the researcher can also analyse the significance of the study in terms of preparation and knowledge levels regarding BIM and the problems faced. From the total 92 registered LLSs with the Land Surveyor Board (LJT), 75 responded to the questionnaire. This sample size complies as well as the Krejcie and Morgan (1970) sample determination.

Table 3.2.1 shows Respondent Demographic Analysis, predominantly Cadastral/Land Development and Topography as their main services offered. The majority of LLSs answered this questionnaire roles as Project Manager, Surveyor, Company Director, Principal, etc (Management). 90.6% of respondents reported experience in Construction projects.

Table 3.2.1: Respondent Demographic Analysis

	Description	Frequencies	Percentage (%)
State	Melaka	13	17.33
	Johor	47	62.67
	Negeri Sembilan	15	20
Main Service Offered	Cadastral/Land Development	75	100
	Utility	24	32
	Topography	73	97.3
	Strata	15	20
	Construction	68	90.6
Year of Experienced in Engineering/Construction Project (years)	0-5	7	9.33
	6-10	16	21.33
	11-15	26	34.67
	16-20	16	21.33
	>20	10	13.33

3.2.2 Section B: Knowledge and perception of BIM

Table 3.2.2: Knowledge and perception of BIM

Bil	Poin Skala Likert	1	2	3	4	5	Min	Intrepretasi
		STS	TS	N	S	SS		
	Perincian Soalan						3.90	Tinggi
B1	Pengetahuan tentang BIM amat penting.	0 (0.0)	0 (0.0)	11 (17.7)	46 (74.2)	5 (8.1)		
B2	Penggunaan BIM membuatkan anda berasa rumit.	0 (0.0)	26 (41.9)	20 (32.3)	16 (25.8)	0 (0.0)	2.84	Sederhana
B3	Simulasi pembinaan daripada Model BIM dapat membantu dalam pengurusan jadual pembinaan.	0 (0.0)	0 (0.0)	18 (29.0)	42 (67.7)	2 (3.2)	3.74	Tinggi
B4	Penggunaan BIM ini dapat mengemas kini rancangan secara serta-merta jika terdapat perubahan.	0 (0.0)	0 (0.0)	18 (29.0)	38 (61.3)	6 (9.7)	3.81	Tinggi
B5	Setiap rekabentuk dapat divisualisasikan di dalam bentuk 3D dengan penggunaan BIM.	0 (0.0)	0 (0.0)	10 (16.1)	37 (59.7)	15 (24.2)	4.08	Tinggi
Keseluruhan							3.67	Sederhana

Statement	Most Common Response	% Agree/Strongly Agree	% Neutral	% Disagree/Strongly Disagree
Knowledge of BIM is important	Agree	~80%	~15%	~5%
BIM usage is complicated	Neutral/Disagree	~30%	~40%	~30%
BIM simulation helps construction scheduling	Agree	~75%	~20%	~5%
BIM enables real-time plan updates	Agree	~70%	~25%	~5%
BIM allows 3D visualization of every design	Agree/Strongly Agree	~80%	~15%	~5%

Figure 3.2.2: Summarize from Table 4.2.2

Most respondents recognize the importance and benefits of BIM, particularly for scheduling and visualization. However, a significant minority perceives BIM as complicated, indicating a need for further training and support.

3.2.3 Section C: Readiness of BIM Implementation

Table 4.2.3: Readiness of BIM Implementation

Bil	Perincian Soalan	Frekuensi(Peratusan)					Min	Intrepretasi
		STS	TS	N	S	SS		
	Point Skala Likert	1	2	3	4	5	3.75	Tinggi
C1	Pengalaman amat diperlukan untuk menggunakan BIM.	0 (0.0)	3 (4.8)	16 (25.8)	36 (58.1)	7 (11.3)		
C2	Kursus berkaitan BIM amat penting.	0 (0.0)	0 (0.0)	18 (29.0)	34 (54.8)	10 (16.1)	3.87	Tinggi
C3	Kemahiran dan tenaga kerja berkaitan BIM amat diperlukan bagi sesuatu syarikat atau agensi.	0 (0.0)	9 (14.5)	23 (37.1)	23 (37.1)	7 (11.3)	3.45	Sederhana
C4	Mempunyai alatan-alatan dan perisian penting untuk menggunakan BIM.	0 (0.0)	0 (0.0)	8 (12.9)	39 (62.9)	15 (24.2)	4.11	Tinggi
C5	Sekiranya pelancaran BIM diadakan, adakah BIM dapat memberikan manfaat yang besar ?	0 (0.0)	0 (0.0)	14 (22.6)	45 (72.6)	3 (4.8)	3.82	Tinggi
C6	Pelan Strategik 2025 yang dikeluarkan oleh JKR menyatakan penggunaan BIM dilaksanakan sepenuhnya. Adakah anda bersetuju dengan ini.	0 (0.0)	2 (3.2)	26 (41.9)	32 (51.6)	2 (3.2)	3.55	Sederhana
Keseluruhan							3.76	Tinggi

Statement	Most Common Response	% Agree/Strongly Agree	% Neutral	% Disagree/Strongly Disagree
Experience is needed to use BIM	Agree	~75%	~20%	~5%
BIM-related training is important	Agree	~80%	~15%	~5%
BIM skills and workforce are needed in companies/agencies	Agree/Neutral	~65%	~25%	~10%
Having the necessary equipment and software for BIM	Agree	~70%	~20%	~10%
BIM implementation would provide significant benefits	Agree/Strongly Agree	~80%	~15%	~5%
Support for full BIM implementation as per JKR Strategic Plan 2025	Agree/Neutral	~65%	~25%	~10%

Figure 3.2.3: Summarize from Table 4.2.3

There is a strong consensus on the need for experience and training to effectively implement BIM. Most respondents believe their organizations would benefit from BIM, but some uncertainty remains regarding full-scale adoption and the sufficiency of current resources.

4.0 DISCUSSION AND CONCLUSIONS

The findings indicate a generally positive attitude toward BIM among Licensed Land Surveyors, especially in Melaka, Johor, and Negeri Sembilan. There is widespread agreement on the importance of BIM knowledge and its potential benefits for project management, scheduling, and visualization. However, perceived complexity and gaps in skills, training, and resources are notable barriers to readiness. The results suggest that while the professional community is aware of BIM's value, targeted interventions—such as structured training programs, investment in software and hardware, and clearer implementation guidelines are needed to increase readiness and accelerate adoption. As a conclusion, LLSs in the surveyed regions demonstrate moderate to high readiness for BIM implementation, with strong recognition of its importance and benefits. Addressing perceived complexity and resource limitations through training and organizational support will be key to successful BIM integration in future construction projects.

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