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Transition Risk Assessment in Implementation of Building Information Modelling (BIM) for Industrialized Building System (IBS) Projects

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KEYWORDS

Transition risk
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ABSTRACT

This paper examines the transition risks in implementing BIM and IBS technologies to improve their integration in construction. While ICT is essential for IBS, its potential is underutilized. Combining BIM and IBS gives significant benefits, but technical, financial, managerial and legal risks need to be addressed for better adoption. The study investigates transition risk factors for BIM-IBS adaptation among contractors, evaluates the Technology Readiness Index (TRI) for integration, and explores the relationship between risks and TRI. Semi-structured interviews were conducted with contractors in Malaysia's Central Region (Selangor and Kuala Lumpur) registered with CIDB, with grades G4 to G7 and at least five years of experience. Findings indicate that technology risk is the main concern for the first question, financial risk for the second, and managerial risk for the third and fourth. Overall, the transition risk for BIM in IBS projects is moderate, with managerial risks being the most significant.

1. INTRODUCTION

The construction industry has evolved with technological advancements like Industrialized Building System (IBS) and Building Information Modelling (BIM). IBS improves productivity by reducing waste, labour, and costs through prefabrication, while BIM enhances project quality, scheduling, and cost control by creating digital building models [8]; [1]. Both are promoted by governments, especially in Malaysia and the UK, to modernize the industry. The global BIM market is expected to grow due to these initiatives and the demand for efficient construction methods [3].

2. LITERATURE REVIEW

BIM, a digital construction tool, enhances decision-making, safety, and efficiency through virtual planning and lifecycle data integration, advancing from 3D modelling to 7D sustainability [4]. While Malaysia lags countries like the UK, initiatives like the CITP and a 2024 mandate for large projects, along with the Malaysia BIM Association, are boosting adoption [5];[6]. Introduced in the 1960s, Malaysia's IBS uses off-site production and standardization to improve construction quality and efficiency. Common systems include precast concrete, formwork, and steel framing, with precast concrete being the most widely used. Despite adoption in 84% of government projects, challenges like high costs and a skilled labour shortage persist [7]. The government continues promoting IBS to reduce foreign labour reliance and improve efficiency [2]. For this study, precast concrete framed buildings will be the chosen, as they are the most widely used IBS in Malaysia.

3. RESULTS AND DISCUSSION

This study employed semi-structured interviews, conducted in-person and virtually, with five BIM specialists from academia, business, and construction projects. Participants, selected for their IBS project experience, BIM knowledge, and at least five years in construction, were informed of the study's purpose and assured data confidentiality. The Table 1 below shows the demographic of BIM expert:

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Table 1 Demographic of BIM Expert

Type	Description	Number of Panels	Percentage (%)
Gender	Female	1	25
	Male	4	75
Position	Professional Engineers	5	100
Working Experience	5-10 years	1	20
	11-15 years	-	-
	16-20 years	3	60
	More than 20 years	1	20

Table 1 summarizes the demographics of 5 BIM expert panellists: 75% male and 25% female, all professional engineers. In terms of experience, 20% have 5-10 years, 60% have 16-20 years, and 20% have over 20 years, with none in the 11–15-year range, reflecting a predominantly male and highly experienced group.

Table 2 Important factors before successful BIM integration in an IBS project

Legend: P1-P5: Panel

Panel / Factors	P1	P2	P3	P4	P5
Managerial Risk		√	√		
Financial Risk			√	√	√
Technology Risk	√	√	√		√
Legal Risk			√	√	
Individual Risk	√			√	
Time Risk				√	

Table 2 highlights key risk factors for successful BIM integration in IBS projects, assessed by five panels (P1-P5). Technology risk is the most critical (score 4), followed by financial risk (3). Managerial, legal, and individual risks each score 2, while time risk is the least critical (score 1). Addressing these risks is crucial for BIM adoption in IBS projects.

Table 3 The readiness of an organization to transit from current practices to BIM in an IBS project

Legend: P1-P5: Panel

Panel / Factors	P1	P2	P3	P4	P5
Managerial Risk					
Financial Risk	√	√			√
Technology Risk			√	√	
Legal Risk					
Individual Risk			√	√	
Time Risk					

Table 3 evaluates organizational readiness for BIM in IBS projects, focusing on six risk factors. Financial and technology risks are the most significant (scores of 3 and 2), followed by individual risk (score 2). Managerial, legal, and time risks are not considered issues (score 0). Addressing financial, technological, and individual factors is key for a successful BIM transition in IBS projects.

Table 4 The most common risks preventing the transition from current practices to BIM for IBS projects

Legend: P1-P5: Panel

Panel / Factors	P1	P2	P3	P4	P5
Managerial Risk	√	√	√	√	
Financial Risk		√	√		√
Technology Risk					
Legal Risk					
Individual Risk			√		
Time Risk	√				√

Table 4 highlights key risks hindering BIM adoption in IBS projects, with managerial risk being the most significant (score 4), followed by financial (3) and time risks (2). Individual risk scores 1, while technology and legal risks are not considered issues (score 0). Addressing managerial, financial, and time challenges is crucial for successful BIM adoption.

Table 5 Examples of possible risks encountered in moving towards BIM-IBS technology

Legend: P1-P5: Panel

Panel / Factors	P1	P2	P3	P4	P5
Managerial Risk	√	√	√	√	
Financial Risk	√	√	√		
Technology Risk			√	√	√
Legal Risk				√	√
Individual Risk				√	
Time Risk					√

The Table 5 highlights risks in transitioning to BIM in IBS projects, with managerial risk being the most critical (score 4). Financial and technology risks score 3, while legal risks score 2. Individual and time risks are less significant, scoring 1. The data emphasizes the importance of focusing on management, financial planning, and technology readiness for successful BIM adoption.

Table 6 The level of risk for planning to transit from current practice to BIM for IBS projects

Legend: P1-P5: Panel

Panel / Level of Risk	P1	P2	P3	P4	P5
High					
Moderate	√	√	√	√	
Low					√

Table 6 shows that major risks for transitioning to BIM in IBS projects are moderate, with 4 panels indicating this level, while 1 panel indicates low risk.

Table 7 Summary the major factor of transition risks by the questions

Legend: P1-P5: Panel
Q1-Q5: Question

Factors / Question	Major Factor of Transition Risk
Q1	Technology risk
Q2	Financial risk
Q3	Managerial risk
Q4	Managerial risk

From Table 7, the key transition risks are technology risk for question 1, financial risk for question 2, and managerial risk for questions 3 and 4. The overall risk level for transitioning to BIM in IBS projects is moderate, with only one respondent indicating low risk.

4. CONCLUSION

From these results, it can be concluded that the major factors of transition risk are managerial risk and the level of risk for planning to transit to BIM for IBS projects is moderate.

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