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The Current Status of BIM Implementation for Project Management in Nepalese Construction Projects: Challenges and Future Prospects

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Abstract
The global construction industry has adopted Building Information Modeling (BIM) as a revolutionary method to boost project efficiency while controlling costs and enhancing communication between stakeholders. BIM adoption in Nepal exists at a basic stage because the population lacks awareness about BIM while skilled professionals are scarce and supportive policies are non-existent. The research examines BIM project management practices in Nepalese construction projects while determining existing obstacles and potential future developments. The research used a mixed-methods design which integrated expert interview findings with survey data results. The results show that younger professionals demonstrate increasing interest in BIM despite facing major implementation challenges including high initial costs and organizational resistance and insufficient training. The statistical evaluation of survey responses through descriptive statistics and correlation tests shows that participants have positive views about BIM's advantages for time management and cost control and quality enhancement. The research provides practical recommendations for policy makers to implement alongside industry-academia partnerships and a step-by-step plan to advance BIM adoption in Nepal.

Keywords
Building Information Modeling (BIM), Project Management, Nepal, Construction Industry, BIM Adoption, Challenges, Future Prospects.

1. Introduction

1.1 Background of the Study

The construction industry in Nepal plays a major role in national GDP by contributing 5.85% to the FY 2023/24 GDP according to the National Statistics Office of GoN. The industry maintains ongoing difficulties with delayed projects and excessive costs and reduced productivity levels [1]. The industry faces efficiency challenges because of traditional practices and fragmented workflows and limited digitalization [2]. Building Information Modeling (BIM) has gained worldwide recognition because it improves project delivery while reducing errors and enhancing stakeholder collaboration [3]; [4]. The Nepalese construction industry shows limited BIM adoption because it lacks skilled workers and requires significant initial spending and lacks standard implementation frameworks [5]; [6]. This research examines BIM adoption in Nepalese construction projects through project management lenses by analyzing existing practices and adoption challenges and potential future adoption possibilities.

1.2 Statement of the Problem

The global advancement of Building Information Modeling (BIM) has not been adopted in developing countries like Nepal because of low awareness, technical challenges, and lack of skilled professionals [7]; [8]. It is important to assess the current situation, advantages, difficulties, and potential of BIM to promote its use in the Nepalese construction industry.

1.3 Research Objectives

The study aims:

1. To determine the current awareness and actual application of Building Information Modeling (BIM).
2. To determine the perceived advantages of using BIM in construction projects.
3. To determine the main obstacles and challenges in the implementation of BIM.
4. To determine the future outlook and preparedness for the wider adoption of BIM.

1.4. Research Questions

1. What is the current level of BIM awareness and usage?
2. What are the perceived benefits of BIM?
3. What challenges hinder BIM implementation?
4. What is the future outlook for BIM adoption?

2. Literature Review

BIM functions as a digital system which unites construction planning with designing and project management through a unified model [9]; [10]. The implementation of digital tools through BIM provides enhanced cost management and time control along with reduced errors and improved communication. The public sector in the UK, USA and Singapore has made BIM mandatory for projects which has led to its increased adoption [11]; [12]. The developing nations face specific challenges because they lack essential infrastructure while showing resistance to change and lacking regulatory frameworks [13]; [14]. The design phase in Nepal utilizes BIM for visualization purposes but the tool shows limited application in construction and project management activities [6]; [5]. The study recommended three improvements for

BIM integration in Nepalese construction projects which include training orientation and changes to government policy and industry collaboration [15]; [16]. BIM functions as a digital system which enables construction planning alongside designing and project management through unified modeling for different disciplines [9]; [10].

3. Research Methodology

The research used a mixed-methods approach to study BIM utilization in Nepalese construction projects. The research collected both quantitative and qualitative data to achieve a complete understanding.

Research Design:

The research used both structured questionnaire surveys and semi-structured interviews as its data collection methods. The analysis of quantitative data in SPSS included descriptive statistics and Relative Importance Index (RII) and ranking methods. The thematic analysis of Key Informant Interviews (KII) data revealed practical insights and stakeholder perceptions.

Data Analysis Methods:

1. Descriptive Statistics

The demographic data including age, gender, education and professional experience were analyzed using descriptive statistics such as frequency, percentage, mean and standard deviation.

- Mean ($\bar{x}$):
  $\bar{x} = \sum x / n$
  Where:
  x = Individual value,
  n = Number of observations

- Standard Deviation (SD):
  $SD = \sqrt{(\sum(x - \bar{x})^2 / (n - 1))}$

2. Relative Importance Index (RII)

The RII was used to rank the significance of factors related to BIM adoption, benefits, and challenges. Each item was rated on a 5-point Likert scale.

- **Formula**:

$RII = \sum w / (A \times N)$

where:
w = weight assigned to each response (1 to 5),

A = highest weight (5 in this study),
N = total number of respondents

3. ***Ranking***

Factors were ranked in descending order based on their RII values. The highest RII indicated the most significant factor.

4. ***Key Informant Interviews (KII)***

KII data were analyzed using **thematic analysis**. Major responses were categorized into themes, which were then compared and triangulated with the quantitative findings to enhance interpretation and credibility.

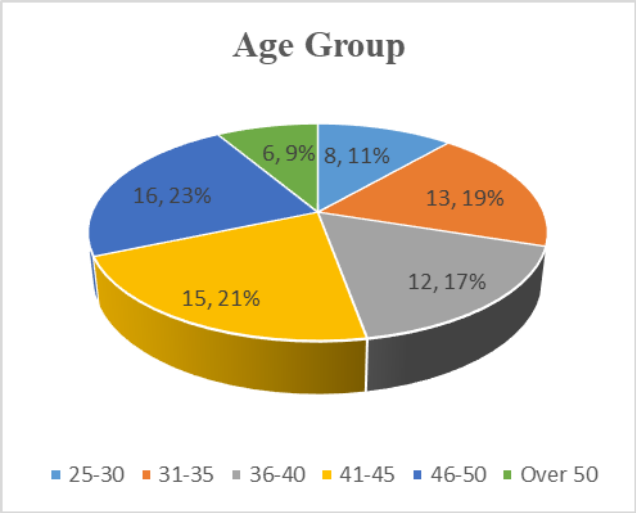
Reliability and Validity of the Instrument

The reliability of the questionnaire was checked by calculating Cronbach's alpha for Sections C, D, E, and F which included BIM awareness, usage, benefits, and prospects. The obtained value was **0.857**, indicating high reliability.

The research established **content validity** through both literature review and expert consultation. The questionnaire contained all necessary BIM dimensions that matched research objectives which confirmed its construct validity.

4. Results and Discussion

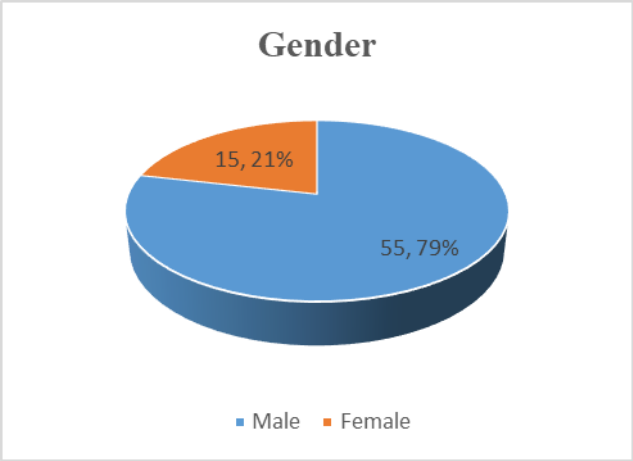
4.1 Section B: Demographic Results:



Age Distribution of Respondents

The respondents' ages are distributed across several groups. The largest group is aged **46–50**, comprising **23% (16 respondents)**. This is followed by **41–45 years** at **21% (15 respondents)** and **36–40 years** at **17% (12 respondents)**. The **31–35** age group accounts for **19% (13 respondents)**, while **25–30** makes up **11% (8 respondents)**. Only **9% (6 respondents)** are aged **over 50**.

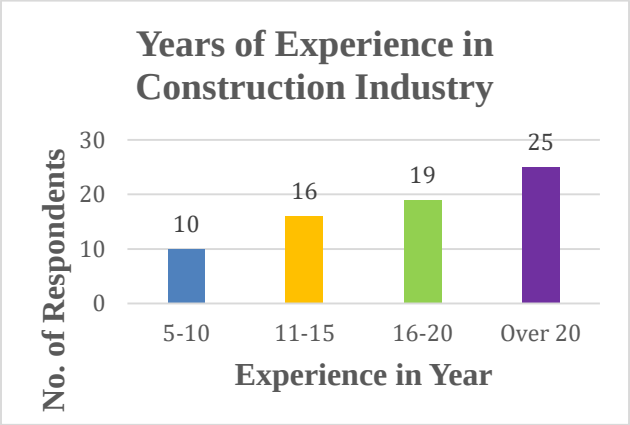
Figure 4.1: Age Group



Gender Distribution of Respondents

The survey results showed that **79%** of participants (**55 individuals**) identified as Male and **21%** (**15 individuals**) identified as Female. The survey results show that males participated much more than females.

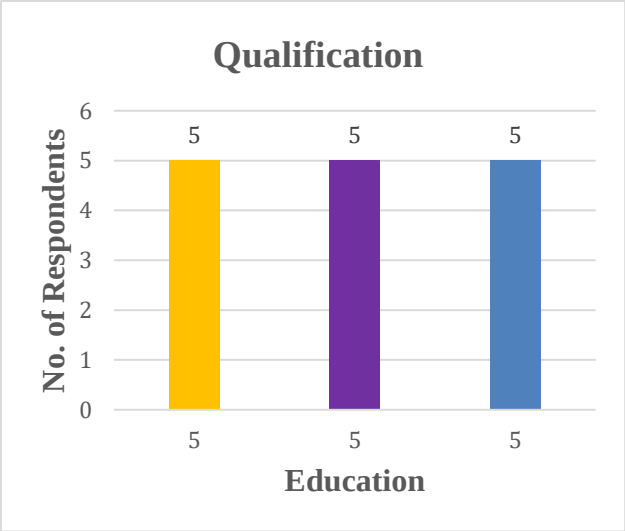
Figure 4.2:



Years of Experience in Construction Industry

The majority of respondents (**36%**) have more than **20 years** of experience, followed by **27%** with **16–20 years**, **23% with 11–15 years**, and **14% with 5–10 years**, which shows that most of the respondents are highly experienced professionals.

Figure 4.3: Years of Experience



Qualification

The majority of respondents (**76%**) hold a **Master's degree**, followed by **17%** with a **Bachelor's degree**, and **7%** with a **PhD**, indicating a highly qualified group of professionals.

Figure 4.4: Qualification

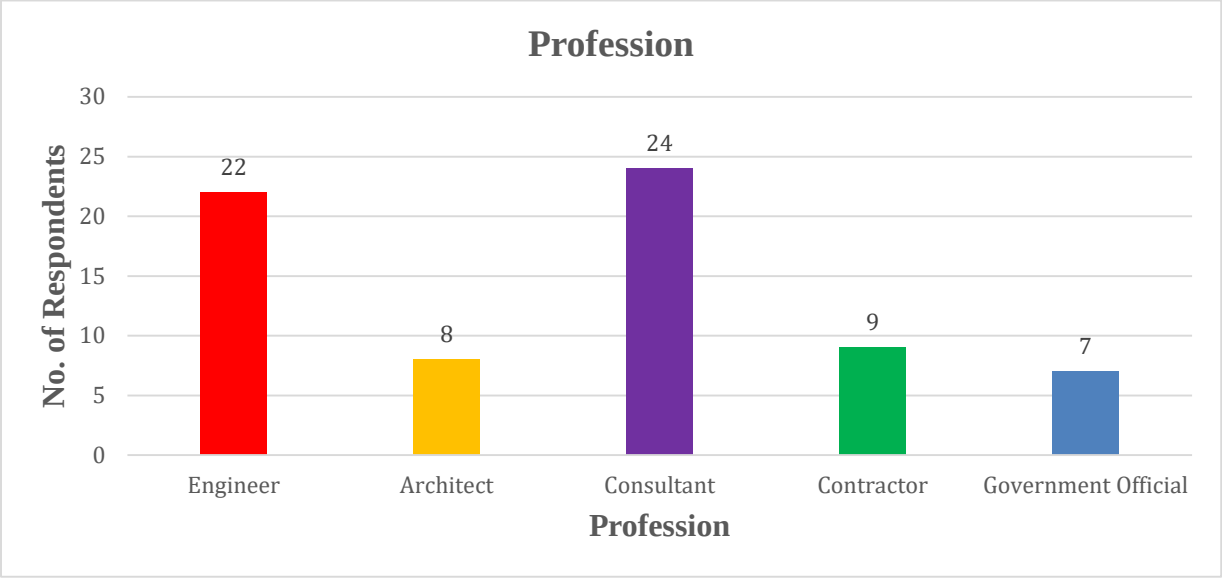


Figure 4.5: Qualification

The survey included consultants (24) and engineers (22) as the largest group followed by contractors (9), architects (8) and government officials (7) who represented a wide range of professionals in the construction industry.

Awareness of BIM

All 70 respondents (100%) indicated they have heard of Building Information Modeling (BIM).

4.2 Section C: BIM Awareness and Usage

Objective 1: To determine the current awareness and actual application of Building Information Modeling (BIM).

The professionals demonstrated a strong general understanding of BIM through their mean familiarity score which reached 3.90 (SD = 0.819). The actual implementation of BIM seemed restricted. The mean usage score reached 4.00 but frequency analysis showed that 5.7% of respondents had no experience while others provided inconsistent higher ratings which indicated possible over reporting or aspirational responses instead of actual widespread implementation. The professionals used BIM most often during construction activities (37.1%) followed by cost estimation (31.4%) and maintenance/operation (21.4%). The application of BIM remained minimal during the initial project stages of planning and scheduling (10%). The findings show that professionals have moderate to high awareness about BIM yet actual adoption remains restricted especially during project initiation and within public sector organizations. The difference between knowledge of BIM and its practical implementation likely results from obstacles including high costs and insufficient training and insufficient policy backing.

4.3 Section D: Benefits of BIM

Objective 2: To determine the perceived advantages of using BIM in construction projects.

Table 4.1: Descriptive Statistics of Perceived Benefits of BIM

		Fact1	Fact2	Fact3	Fact4	Fact5	Fact6
	Valid	70	70	70	70	70	70
	Missing	0	0	0	0	0	0
Mean		4.71	4.59	4.70	4.63	4.73	4.76
Std. Deviation		0.455	0.496	0.462	0.487	0.448	0.432

Table 4.2: RII and RANK Calculations for Perceived and Benefits of BIM

Factors	SA	A	N	DA	SDA	5*SA	4*A	3*N	2*DA	1*SDA	Total	Total(N)	A*N	RII	Rank
Fact1	50	20	0	0	0	250	80	0	0	0	330	70	350	0.943	3
Fact2	41	29	0	0	0	205	116	0	0	0	321	70	350	0.917	6
Fact3	49	21	0	0	0	245	84	0	0	0	329	70	350	0.94	4
Fact4	44	26	0	0	0	220	104	0	0	0	324	70	350	0.926	5
Fact5	51	19	0	0	0	255	76	0	0	0	331	70	350	0.946	2
Fact6	53	17	0	0	0	265	68	0	0	0	333	70	350	0.951	1

Where,
Fact1 = BIM improves communication and collaboration among stakeholders
Fact2 = BIM reduces project costs.
Fact3 = BIM helps manage project timelines better.
Fact4 = BIM enhances construction quality.
Fact5 = BIM identifies and resolves design clashes before construction.
Fact6 = BIM is essential for future construction project success in Nepal.

Analysis:

The evaluation of Building Information Modeling (BIM) perceived benefits served to determine the reasons behind its restricted adoption in Nepalese construction projects. The reasoning is that if stakeholders acknowledge substantial benefits yet adoption remains low, then significant technical, organizational, or systemic barriers may be at play.

Descriptive Statistics of Perceived Benefits

The data presented in Table 4.1 shows that 70 respondents evaluated all six benefit factors (Fact1 to Fact6) without any missing information. The respondents strongly agreed about BIM advantages through their ratings which ranged from 4.59 to 4.76 on the 5-point Likert scale. The respondents gave Fact6 (Mean = 4.76) the highest rating because they believe BIM will be crucial for future construction project success in Nepal. The technical effectiveness of BIM was demonstrated through Fact5 (Mean = 4.73) which showed that the system detects and fixes design clashes prior to construction. The lowest score of Fact2

(Mean = 4.59) "BIM reduces project costs" remained high but indicated that this benefit might be viewed as less immediate or tangible. The standard deviations ranged from 0.432 to 0.496 which indicates that the participants provided consistent responses.

Relative Importance Index (RII) and Ranking

Based on Table 4.2, RII analysis ranked the benefits as follows:

1. Fact6 – RII: 0.951
2. Fact5 – RII: 0.946
3. Fact1 – RII: 0.943
4. Fact3 – RII: 0.940
5. Fact4 – RII: 0.926
6. Fact2 – RII: 0.917

The highest-ranked benefits relate to future project success and technical problem-solving, while cost-related advantages were perceived as less critical—potentially reflecting limited local experience with cost savings from BIM.

Interpretation and Link to Barriers

The high scores demonstrate that BIM's potential is widely recognized by the industry. The limited implementation of BIM indicates that essential barriers prevent its widespread adoption:

- Skills and Training Gaps: Professionals who value BIM benefits such as communication (Fact1) and time management (Fact3) may not possess the skills needed to maximize BIM tool capabilities.
- Lack of Investment: The low ranking of cost reduction (Fact2) could result from unclear return on investment expectations or insufficient budget allocation.
- Institutional Resistance: The essential nature of BIM (Fact6) does not guarantee its adoption because of established practices and the absence of mandates and inflexible organizational structures.
- Technology Access: The high perceived benefits of BIM do not automatically translate into practical usage because of software availability and hardware and support infrastructure issues.

The construction sector stakeholders in Nepal understand BIM benefits well but its restricted adoption reveals educational and technical and systemic barriers. The complete realization of BIM's potential for project delivery transformation demands specific policies together with capacity development and enhanced institutional support.

4.4 Section E: Barriers and Challenges

Objective 3: To determine the main obstacles and challenges in the implementation of BIM.

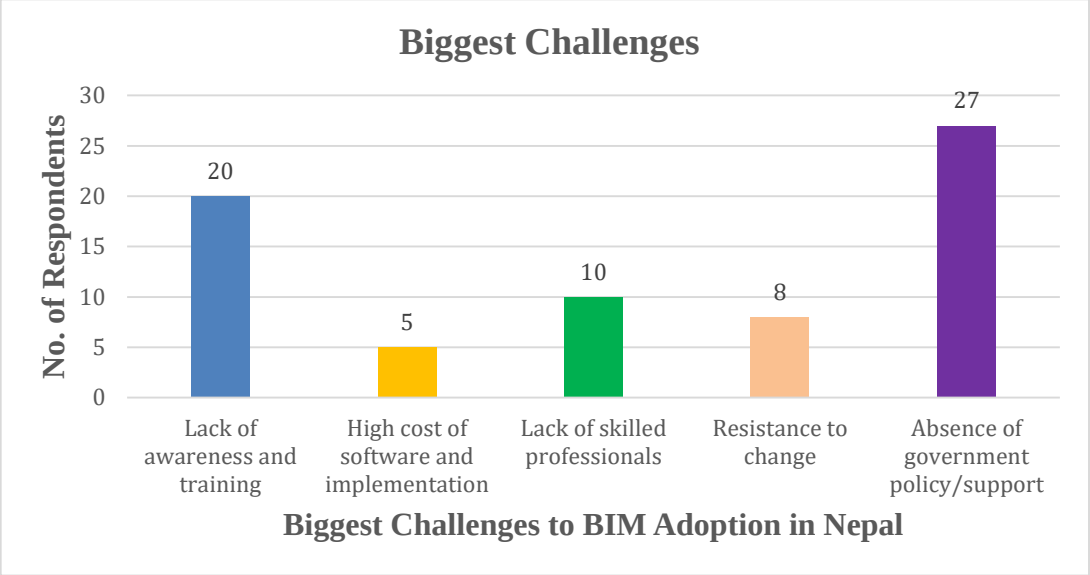


Figure 4.6: Challenges to BIM Adoption

The survey asked respondents to identify the main obstacles preventing BIM adoption in Nepal. The survey results are summarized below:

The survey asked participants to identify key obstacles preventing BIM adoption in Nepal. The survey results are summarized below:

The survey results show that 27 respondents (38.6%) identified the absence of government policy/support as the main barrier to BIM adoption. The survey results show that BIM adoption faces a major institutional challenge because there are no policy mandates or incentives to support its adoption.

The survey results show that 20 respondents (28.6%) identified lack of awareness and training as a major issue which indicates a significant knowledge and capacity gap in the industry.

The survey results show that 10 respondents (14.3%) identified lack of skilled professionals as a major challenge for BIM implementation. The survey results show that qualified personnel are scarce to implement BIM practices effectively.

The survey results show that 8 respondents (11.4%) identified resistance to change as a major challenge which indicates some cultural or organizational resistance to adopt digital methodologies over traditional practices.

The survey results show that high software and implementation costs were the least common challenge among respondents with only 5 participants (7.1%) reporting this issue. The survey results show that financial constraints exist but they do not represent the main obstacle.

Interpretation

The research shows that BIM adoption in Nepal faces mainly institutional and capacity barriers including no regulatory frameworks, low awareness and lack of trained professionals. On the other hand, challenges that are often assumed to be major obstacles such as high costs or resistance to change seem to be less of a problem. This highlights the need for government-led policy interventions, training programs and capacity building initiatives to create a supportive environment for BIM implementation.

4.5 Section F: Future Prospects

Objective 4: To determine the future outlook and preparedness for the wider adoption of BIM.

1. Should BIM be mandatory in large public projects in Nepal?

Table 4.3: BIM Mandatory

Should BIM be mandatory in large public projects in Nepal?			
		Frequency	Percent
	Yes	58	82.9
	No	12	17.1
	Total	70	100.0

The survey results showed that 58 out of 70 participants (82.9%) backed the requirement of BIM implementation in major public projects across Nepal. The remaining 12 participants (17.1%) opposed this requirement. The industry professionals demonstrate strong agreement about BIM's capability to boost project efficiency and coordination and improve outcomes in major public construction projects. The sector demonstrates increasing readiness to adopt digital transformation through its adoption of high-impact government projects.

2. What support is necessary for BIM implementation in Nepal?

Table 4.4: BIM Implementation Necessity

What support is necessary for BIM implementation in Nepal?		
Factors	Frequency	Percent
Training programs for professionals	13	18.6
Government policies and regulations promoting BIM	12	17.1
Financial support or subsidies for BIM tools	12	17.1
Awareness campaigns about BIM benefits	28	40.0
Support from construction companies and industry leaders	5	7.1
Total	70	100.0

The survey participants identified multiple essential support types for BIM adoption implementation.

- The survey results showed that awareness campaigns stand as the most essential support mechanism because 28 respondents (40.0%) agreed that BIM benefits need to be understood throughout the construction industry.
- The need for professional training programs received support from 13 respondents who also recognized the ongoing requirement for skill development and capacity building.
- The combination of government policies and financial support/subsidies received equal support from 12 respondents (17.1% each) because they both play essential roles in expanding BIM adoption.
- The survey results showed that only 5 respondents (7.1%) believed industry leadership together with company-level support were essential for BIM adoption.

Interpretation

The responses indicate that stakeholders are optimistic about the future role of BIM, especially in public projects, but there are still some key prerequisites for its successful implementation. The stress on awareness and training indicates a need for education-driven initiatives, while the calls for policy reform and financial support indicate that the government is expected to play a central role in institutionalizing BIM practices.

5. Conclusion and Recommendations

Conclusion

The research investigated BIM adoption status and its benefits and challenges and future prospects within Nepal's construction sector. The research data shows that BIM receives strong industry backing because it improves communication and reduces design conflicts while delivering better project results. The adoption of BIM faces major obstacles because of insufficient government policy (38.6%) and inadequate awareness and training programs (28.6%).

The industry demonstrates readiness for extensive BIM implementation because 82.9% of respondent's support making BIM mandatory for large public projects. The industry requires awareness campaigns (40%) and training programs and policy support and financial incentives to advance BIM adoption which demonstrates the need for coordinated institutional and educational efforts.

Recommendations

1. **Establish National BIM Policy:** The government should develop specific rules and guidelines which apply to public construction projects.
2. **Mandate BIM in Large Public Projects:** The organization should demonstrate BIM implementation to speed up its adoption across the entire sector.
3. **Conduct Awareness Campaigns:** BIM benefits should be promoted through outreach activities and educational programs.
4. **Enhance Training and Capacity Building:** Academic institutions and professional programs should implement BIM curricula.

5. **Offer Financial Incentives:** The government should provide financial support to small businesses through tax benefits or subsidies.
6. **Promote Public–Private Partnerships:** The organization should foster public-private partnerships to implement pilot projects and exchange best practices.

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