

# A comprehensive comparison between traditional project management and BIM-based management: Evidence from the Vietinbank Tower project

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## KEYWORDS

Building Information Modeling (BIM)  
Project Management  
Vietinbank Tower  
Clash Detection  
4D Scheduling  
LOD 400

## ABSTRACT

The construction industry is shifting from traditional 2D-based management to Building Information Modeling (BIM) to handle the increasing complexity of high-rise buildings. This paper provides a rigorous comparison between traditional Project Management (PM) and BIM-integrated PM. By utilizing the Vietinbank Tower - a "Special Grade" project in Hanoi - as a case study, the research demonstrates how BIM resolves deep-seated issues in coordination, quantity takeoff, and scheduling. The findings suggest that while BIM requires higher initial investment, it significantly reduces risks and improves structural quality through Level of Development (LOD) 400 modeling and automated clash detection.

## 1. Introduction

### 1.1. Background of the Construction Industry in Vietnam

The global construction industry is currently witnessing a rapid transformation toward super-high-rise and technically complex structures [14], [23]. In developing nations like Vietnam, urbanization has led to a surge in "Special Grade" projects - buildings exceeding 200 meters with sophisticated structural and mechanical systems. However, as the scale of these projects grows, the traditional methods of management, which have remained largely unchanged since the widespread adoption of 2D CAD in the 1980s [9], [11], are reaching their functional limits. Managing thousands of technical drawings, coordinating between dozens of international and local contractors, and maintaining strict budget controls have become monumental challenges that traditional paper-based or 2D-digital workflows can no longer efficiently address.

The traditional construction management workflow in Vietnam has historically relied on fragmented documentation and 2D CAD drawings. This often leads to "information silos" [14], [17], where architects, structural engineers, and MEP (Mechanical, Electrical, and Plumbing) contractors work in isolation. For complex projects like the Vietinbank Tower, these silos result in massive on-site clashes, progress delays, and cost overruns.

### 1.2. The Limitations of Traditional Project Management (TPM)

Traditional Project Management in construction is characterized by a fragmented approach. Architects, structural engineers, and MEP (Mechanical, Electrical, and Plumbing) contractors often work in "silos" where information is exchanged through 2D drawings. This workflow leads to several critical pain points:

- **Information Silos:** Data is disconnected. A change in the architectural layout may not be immediately reflected in the structural or MEP designs, leading to significant errors.

- **Visualization Gap:** 2D drawings require engineers to mentally reconstruct a 3D reality. This human-dependent process is prone to misinterpretation, especially in complex areas like elevator cores or steel - joint assemblies.

- **Reactive Problem Solving:** Most design conflicts (clashes) are only discovered during the physical construction phase [14], [22]. This results in costly "re-work," material waste, and schedule delays.

- **Quantity Inaccuracy:** Manual quantity takeoffs (QTO) from 2D plans are labor-intensive and typically carry a 5-10 % error margin [19], [23], complicating financial management and procurement.

### 1.3. Building Information Modeling (BIM) as a Paradigm Shift

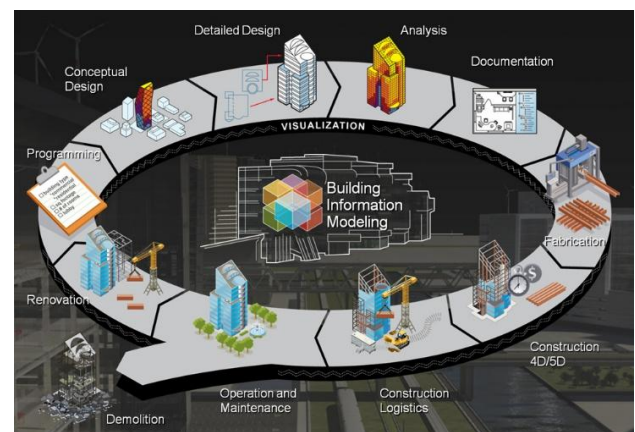


Figure 1. BIM-based lifecycle framework for construction [6].

Building Information Modeling has emerged not merely as a software tool [6], [17], but as a digital methodology to optimize the

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design, construction, and operation of a facility. Unlike 2D CAD, BIM creates a parametric 3D model enriched with data (the "I" in BIM). It allows stakeholders to "build twice" - first in a virtual environment [14], [23] where every beam, pipe, and bolt is coordinated, and then in the physical world.

The industry is currently moving through three eras:

- *The Paper Era*: Prior to the 1980s.
- *The Optimization Era*: The shift from 2D to 3D visualization.
- *The Connectivity Era*: Where BIM meets the Internet of Things (IoT) and Cloud computing to create a synchronized management ecosystem.

#### 1.4. Research Motivation: The Vietinbank Tower Case

The Vietinbank Tower project in Hanoi, Vietnam, serves as a landmark case study for this transition. Standing at a primary height of 363.1 meters with 68 stories, it is one of the most complex high-rise developments in Southeast Asia. The project features a massive "Steel Super Structure," high-performance curtain walls, and intricate MEP systems integrated within a tight urban site.

The involvement of world-class consultants such as Foster + Partners (UK), Turner International (USA), and Halvorson and Partners (USA) alongside local giants like Hoa Binh Construction Group necessitates a high level of digital integration. For the lead contractor, the application of BIM was not just a technical requirement but a strategic necessity to ensure quality and safety while managing a budget exceeding 10,000 billion VND.

#### 1.5. Research Objectives and Scope

This paper seeks to evaluate the practical effectiveness of BIM integrated management versus traditional methods by analyzing real - world data from the Vietinbank Tower. Specifically, the research aims to:

- Quantify the benefits of LOD 400 modeling in reducing design-construction conflicts.
- Compare the efficiency of 4D Scheduling and 5D Cost Estimation against traditional Gantt charts and manual takeoff methods.
- Identify the barriers to BIM adoption within the Vietnamese legal and corporate framework.
- Propose a set of solutions for small and large - scale construction firms to transition toward a BIM - centric model.

By bridging the gap between theoretical BIM benefits and on-site implementation challenges, this study provides a comprehensive roadmap for the digital future of Vietnam's construction project management.

## 2. Theoretical framework

### 2.1. Foundations of Construction Project Management (CPM)

Construction Project Management is a multi-disciplinary field focused on the professional management of a project from its inception

to its completion [10]. According to the Project Management Institute (PMI) and the Vietnam Law on Construction (No. 50/2014/QH13), a construction project is a collection of interrelated activities - investment, design, and construction - performed within a fixed timeframe and budget to create a unique product or service.

The success of a project is traditionally governed by the "Triple Constraint" or the "Project Management Triangle":

- *Scope (Quality)*: The technical specifications and functional requirements.
- *Time (Schedule)*: The duration from groundbreaking to handover.
- *Cost (Budget)*: The financial resources allocated for the project.

In the context of the Vietinbank Tower, managing these three constraints is exceptionally challenging due to the specialized nature of "Special Grade" high-rise engineering.

### 2.2. The Traditional Project Management Paradigm (TPM)

The traditional management model, prevalent in Vietnam for decades, relies on a linear, fragmented workflow (Design-Bid-Build).

- *Documentation*: Technical information is stored in disconnected 2D CAD files (DWG) or physical paper prints.
- *Coordination*: Interdisciplinary checks (Architectural vs. Structural vs. MEP) are performed through manual overlays.
- *Data Integrity*: Information often "leaks" during the transition between phases (e.g., from Design to Construction). This results in a lack of a "Single Source of Truth," where different contractors may be working off different versions of the same plan.

### 2.3. Defining Building Information Modeling (BIM)

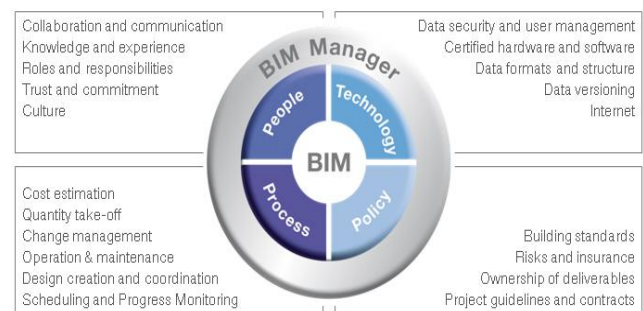


Figure 2. BIM Manager components [6].

BIM is not merely a software tool like AutoCAD; it is a collaborative process and a digital representation of a facility. The US National BIM Standard (NBIMS-US) defines it as [8], [16]: "A digital representation of physical and functional characteristics of a facility... a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle."

According to the research, a successful BIM implementation rests on four core pillars:

- *Process*: Standardized workflows for information exchange.

- *Policy*: Legal frameworks and contract protocols (e.g., BIM execution plans).
- *People*: Trained personnel with specialized BIM roles (BIM Managers, Coordinators).
- *Technology*: Software (Revit, Tekla, Navisworks) and Hardware (High-performance servers/workstations).

#### 2.4. BIM Dimensions (nD BIM)

The theoretical strength of BIM lies in its ability to integrate multi-dimensional data into a single model:

- *3D BIM (Modeling)*: Focuses on geometry, spatial relationships, and visualization [6], [17].
- *4D BIM (Scheduling)*: Integrates the time variable. Construction sequences [12], [19] are linked to model components, allowing for visual progress simulations.
- *5D BIM (Estimation)*: Integrates cost data. Automated quantity takeoffs are extracted from the parametric model to provide real-time budget updates [19], [23].
- *6D/7D BIM*: Focuses on sustainability and long-term facility management post-handover.

#### 2.5. Level of Development (LOD)






100	Generic column element. See B.10.1.	 19 B 1010, 10-L, LOD-100 Floor Structural Frame (Steel Framing Columns)
200	See B.10.10	 20 B 1010, 10-L, LOD-200 Floor Structural Frame (Steel Framing Columns)
300	Element modeling to include: <ul style="list-style-type: none"> <li>• Specific sizes of main vertical structural members modeled per defined structural grid with correct orientation</li> </ul> Required non-graphic information associated with model elements includes: <ul style="list-style-type: none"> <li>• Structural steel materials defined.</li> <li>• Connection details</li> <li>• Finishes, i.e. painted, galvanized, etc.</li> </ul>	 21 B 1010, 10-L, LOD-300 Floor Structural Frame (Steel Framing Columns)
350	Element modeling to include: <ul style="list-style-type: none"> <li>• Actual elevations and location of member connections</li> <li>• Large elements of typical connections applied to all structural steel connections such as base plates, gusset plates, anchor rods, etc.</li> <li>• Any miscellaneous steel members with correct orientation</li> <li>• Any steel structure reinforcement such as web stiffeners, sleeve penetrations, etc.</li> </ul>	 22 B 1010, 10-L, LOD-350 Floor Structural Frame (Steel Framing Columns)
400	Element modeling to include: <ul style="list-style-type: none"> <li>• Welds</li> <li>• Capping of members</li> <li>• Cap plates</li> <li>• Washers, nuts, etc.</li> <li>• All assembly elements</li> </ul>	 23 B 1010, 10-L, LOD-400 Floor Structural Frame (Steel Framing Columns)

Figure 3. Illustration of LOD levels.

The Level of Development framework is a standard that allows practitioners to specify the clarity and reliability of content in a BIM model. As projects progress, the LOD increases:

- *LOD 100-200*: Conceptual and schematic design with approximate geometry.
- *LOD 300*: Precise geometry and position suitable for traditional construction.

- *LOD 400*: Detailed modeling suitable for Fabrication and Assembly. For the Vietinbank Tower, LOD 400 is critical as it includes precise details of steel joints, welds, and specific MEP connections required for manufacturing.

- *LOD 500*: The "As - Built" model, verified in the field for operational use.

#### 2.6. Collaborative Environments and Management Systems

Modern BIM-PM utilizes specialized systems to ensure data continuity:

- *Common Data Environment (CDE)*: A centralized digital hub (such as SharePoint or Autodesk BIM 360) where all stakeholders upload and verify information.
- *Location-Based Management System (LBMS)*: Unlike traditional Gantt charts, LBMS organizes work based on physical locations (e.g., by floor or zone). When integrated with BIM, it allows managers to optimize resource allocation and prevent crew congestion, which was vital for the multi-zone podium of the Vietinbank project.

### 3. Case study: the vietinbank tower project

#### 3.1. Project Overview and Strategic Significance



Figure 4. Project perspective.

The Vietinbank Tower, located in the TM01 lot of the Ciputra New Urban Area (Tay Ho, Hanoi), stands as one of Vietnam's most ambitious architectural landmarks. As a "Special Grade" project, it serves as the strategic headquarters for the Vietnam Joint Stock Commercial Bank for Industry and Trade. With a total investment of approximately 10,267 billion VND, the project was designed to be a "smart building" (IBMS) meeting international standards for finance and hospitality.

The project scale includes:

- Total Site Area: 43,000 m<sup>2</sup>.
- Structure: Two towers rising from a shared 9 - story podium.
  - + Office Tower: 68 stories, 363.1 meters high.
  - + Hotel/Residential Tower: 48 stories, 230.5 meters high.
- Basements: 3 levels for technical infrastructure and parking.

The project brought together a world - class consortium of consultants, including Foster + Partners (UK) as the lead architect, Turner International (USA) for project and construction management, and Halvorson and Partners (USA) for structural design. This high-level international collaboration necessitated a sophisticated digital management framework.

### 3.2. Technical Challenges and Structural Complexity

The Vietinbank Tower presents several unique engineering challenges that rendered traditional 2D management insufficient:

- *Steel Super-Structure:* The tower utilizes a massive structural steel frame encased in concrete. A critical feature is the transfer truss system located every 21 floors, which manages the vertical load distribution.

- *Complex Enclosure:* The building utilizes a high-performance curtain wall system integrated with Glassfiber Reinforced Concrete (GRC) panels. The GRC panels require extreme precision for installation on high-rise levels.

- *Dense MEP Systems:* As a smart building, the Mechanical, Electrical, and Plumbing (MEP) requirements are exceptionally dense. The integration of HVAC, fire protection, and smart-building sensors within limited ceiling spaces created a significant risk of physical clashes.

### 3.3. BIM Implementation Strategy: The LOD 400 Standard

Recognizing the structural complexity, the Project Management Unit (PMU) mandated the application of BIM at a Level of Development (LOD) 400.

Unlike lower LOD levels used for visualization, LOD 400 requires "fabrication-ready" models. Every structural steel joint, bolt, weld, and MEP connection was modeled with precise geometry and technical data. This allowed the joint venture of Hoa Binh Construction Group and Agrimeco to perform virtual mock-ups and extract precise fabrication drawings directly from the BIM model, ensuring that parts manufactured off-site would fit perfectly when hoisted 300 meters into the air.

### 3.4. The Common Data Environment and Collaboration


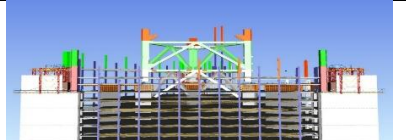

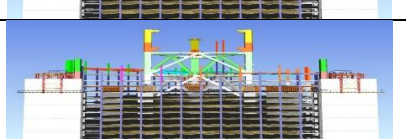

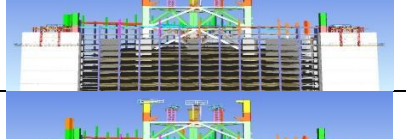

A primary success factor for the project was the establishment of a Common Data Environment (CDE) using a SharePoint-based Web portal. This portal served as the "Single Source of Truth" for all stakeholders:

- *Version Control:* The CDE ensured that contractors in Hanoi were working with the latest architectural revisions approved in London or structural changes from Chicago.

- *RFI Management:* Requests for Information were linked directly to the 3D model, allowing consultants to visualize the specific technical query in its spatial context, speeding up response times.

- *BIM Protocol:* A strict file-naming and color-coding convention (e.g., Grey for Architecture, Blue for HVAC, Red for Fire Protection) was implemented to maintain data integrity across the federated model.

### 3.5. 4D Scheduling and Site Logistics

No.	Order of Days	Description
1	Day 1	
2	Day 2	
3	Day 3	
4	Day 4	
5	Day 5	
6	Day 6	
7	Day 7	

**Figure 5.** 7-days/week sequence of steel structure erection at the construction site.

The project team integrated the construction schedule with the 3D model to create 4D BIM simulations.

- *The 7-Days Cycle:* For the steel super-structure, the team modeled a repeating 7-days installation cycle. This allowed managers to identify potential bottlenecks in crane movement or material delivery before they occurred.

- *Site Logistics (Site Logistics) [20]:* Given the tight constraints of the Ciputra site, 4D BIM was used to simulate the movement of heavy

machinery and the storage of steel members, preventing site congestion and ensuring safety protocols were maintained.

### 3.6. 5D Cost Control and Procurement

By utilizing the data embedded in the LOD 400 components, the project transitioned to 5D BIM for quantity takeoffs (QTO).

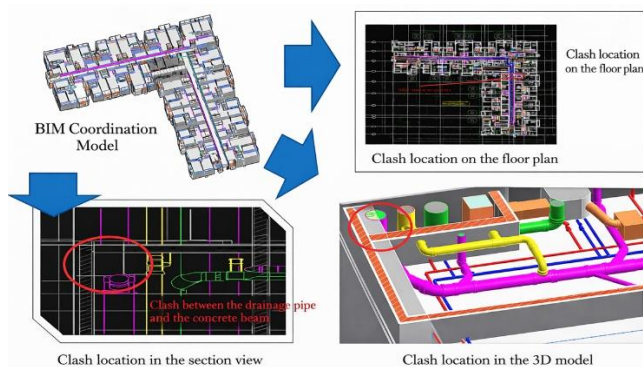
- *Precision Procurement*: For the 30,000 tons of structural steel, the BIM - extracted quantities were used for direct procurement, reducing the traditional 5 % "buffer" waste to less than 1 %.

- *Progress Payment Verification*: Payment certificates for subcontractors were verified against the quantities "installed" in the BIM model, providing a transparent and audit-ready financial trail for the bank.

## 4. Comparative analysis: traditional pm vs. BIM-integrated PM

The transition from traditional methods to BIM at the Vietinbank Tower project represents a fundamental shift in how information is created, managed, and shared. This comparison is analyzed through four critical technical dimensions.

### 4.1. Design Coordination and Clash Detection



**Figure 6.** Identification of clashes between drainage pipes and concrete beams using a BIM coordination model.

- *Traditional Method*: Coordination is performed using 2D CAD overlays (the "Lightbox" method). Engineers from different disciplines (Architectural, Structural, MEP) manually compare paper or digital drawings. This process is highly prone to human error, especially in the vertical dimension (Z-axis). In a project as complex as Vietinbank Tower, which features massive transfer trusses and dense MEP systems, manual coordination often fails to identify "hard clashes" (e.g., a pipe running through a structural beam) until the construction phase.

- *BIM-Integrated Method*: Utilizing LOD 400 models and Navisworks, the project team performs automated clash detection. The software identifies every physical conflict between structural steel, concrete, and mechanical ducts.

+ *Vietinbank Specifics*: BIM allowed the team to resolve over 2,000 conflicts before fabrication. This moved the "conflict resolution" phase from the construction site to the virtual office, significantly reducing re-work costs and material waste.

### 4.2. Quantity Takeoff (QTO) and Cost Estimation (5D BIM)

- *Traditional Method*: Estimators manually measure lengths, areas, and volumes from 2D blueprints. This "manual takeoff" is labor-intensive and has a high risk of misinterpretation. Any design change requires a complete manual recalculation, leading to delays in updating project budgets.

- *BIM-Integrated Method (BIM-PM)*: Quantities are extracted directly from the 3D parametric components. Because the model contains precise geometry and data (e.g., the exact grade of steel for each beam), the 5D BIM environment generates highly accurate cost reports.

+ *Vietinbank Specifics*: For the 30,000 tons of structural steel, BIM provided a dynamic quantity takeoff. When Foster + Partners revised the steel joints, the BIM model updated the total tonnage and cost instantly, ensuring the budget remained transparent and accurate.

### 4.3. Scheduling and Site Logistics (4D BIM)

- *Traditional Method*: Schedules are managed via Gantt charts (MS Project or Primavera). While these tools track time, they lack a visual connection to the physical building. Project managers must "imagine" the state of the building at a specific date, making it difficult to spot logical errors in the construction sequence.

- *BIM-Integrated Method*: 4D BIM links the construction schedule to the 3D model. This creates a visual simulation of the building being constructed over time.

+ *Vietinbank Specifics*: The team implemented a "7-days erection cycle" for the steel super-structure. BIM simulations verified that the tower cranes had sufficient reach and that the site logistics (storage area for steel members) were optimized for the cramped Ciputra site. This ensured that the logistics supported the schedule rather than hindering it.

### 4.4. Information Management and Collaboration (CDE)

- *Traditional Method*: Communication is "fragmented" and "siloed." Information is exchanged via email, paper RFIs (Request for Information), and physical meetings. This leads to version control issues where contractors might work off outdated drawings.

- *BIM-Integrated Method*: All stakeholders work within a Common Data Environment – in this case, a dedicated Sharepoint platform. This acts as the "Single Source of Truth."

+ *Vietinbank Specifics*: Given the international nature of the project (USA, UK, and Vietnam), CDE allowed Turner (USA) and Foster + Partners (UK) to review the models in real-time. Any update made to

the structure in the model was immediately visible to the MEP contractors in Vietnam, ensuring total alignment.

## 5. Results and discussion

The implementation of BIM at the Vietinbank Tower project provides a rich dataset for evaluating the transition from traditional Project Management to BIM-Integrated Project Management. The results are analyzed through technical, financial, and managerial lenses.

### 5.1. Technical Efficiency: The LOD 400 and Clash Detection Impact

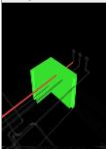



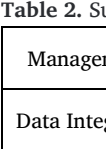
The primary technical achievement was the successful management of the tower's complex structural steel and MEP integration.

- *Identification of Conflicts:* By utilizing Navisworks for federated model coordination, the project team identified over 2,000 "hard" and "soft" clashes before construction moved to the superstructure. In a traditional 2D workflow, these clashes (such as MEP ducts intersecting with the 21st-floor transfer trusses) would likely have been discovered only during physical installation.

- *Reduction in Re-work:* The study indicates that the "virtual construction" phase enabled by LOD 400 reduced on-site re-work costs by approximately 15-20 % in the core areas. This is a significant result, proving that front-loading the effort into high-fidelity modeling drastically lowers the risks during the high-stakes construction phase of super-high-rise buildings.

With BIM, project investment time will be significantly shortened, and resources will be reduced significantly.

**Table 1.** Typical example of a component conflict report [20].

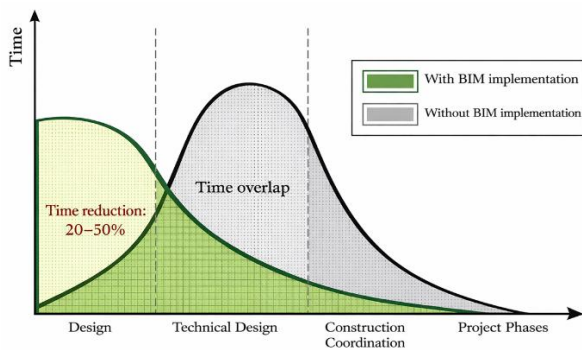
Image	Clash Name	Status	Distance	Grid Location	Description	Date Found	Clash Point	Item 1				Item 2			
								Item ID	Layer	Item Name	Item Type	Item ID	Layer	Item Name	Item Type
	Clash5	Active	-0.158	K-7 : B1	Hard	2017/4/14 09:41.08	x:-86.053, y:-14.358, z:-1.110	Element ID: 10088114	B1	Pipe Types	Line	Element ID: 1309172	B2	Straight: 1120	Solid
	Clash6	Resolved	-0.158	K-7 : B1	Hard	2017/4/14 09:41.08	x:-86.053, y:-14.358, z:-1.110	Element ID: 10088115	B1	Center Line	Line	Element ID: 1309172	B2	Straight: 1120	Solid
	Clash7	Resolved	-0.117	M-27 : B1	Hard	2017/4/14 09:41.08	x:-5.381, y:-3.994, z:-1.664	Element ID: 10081690	B1	Center Line	Line	Element ID: 1302034	B1	Mitered Offset	Solid
	Clash8	Active	-0.117	M-27 : B1	Hard	2017/4/14 09:41.08	x:-5.381, y:-3.994, z:-1.664	Element ID: 10081689	B1	Pipe Types	Line	Element ID: 1302034	B1	Mitered Offset	Solid
	Clash11	Active	-0.085	M-2 : B1	Hard	2017/4/14 09:41.08	x:-102.666, y:-3.750, z:-1.050	Element ID: 10085276	B1	Center Line	Line	Element ID: 1303778	B1	Mitered Offset	Solid

**Table 2.** Summary comparison matrix.

Management Criterion	Traditional (2D CAD)	BIM-Integrated (LOD 400)	Technical Impact
Data Integrity	Disconnected 2D files	Centralized Parametric Model	Eliminates version conflicts
Problem Solving	Reactive (on-site)	Proactive (pre-construction)	Reduces re-work by 15-20 %
Coordination	Manual/Human-led	Automated Clash Detection	Zero "Hard Clashes" on-site
Quantity Takeoff	Error-prone (5-10 % margin)	Automated/Precise (< 1 % margin)	Accurate financial control
Progress Tracking	Abstract (Gantt Charts)	Visual (4D Simulation)	Clearer site logistics
Communication	Fragmented (Email/Paper)	CDE (Sharepoint/Single Source)	Faster RFI response times

**Table 3.** Comparison between Traditional Project Management and BIM-Integrated Project Management [20].

No.	Traditional Project Management	Comparison Criteria	BIM-Integrated Management
1	No initial investment required	IT Infrastructure for BIM	Significant investment required (Software & Hardware)
2	No model creation required	Initial BIM Modeling	Mandatory model creation from the early stages
3	Not available	Construction Sequence & Methodology Simulation	Available (Visual 4D simulation)
4	Not available	Pre-construction Clash Detection & Resolution	Available (Automated/Proactive clash detection)
5	Driven by manual "pushing" and reporting	Schedule Management	Driven by 4D modeling and visual coordination
6	Repetitive manual calculations; disconnected workflows	Quantity Takeoff (QTO)	Single data entry; automated updates upon design changes
7	Based on individual mental visualization/experience	Site Management	Based on precise 3D spatial simulation

**Figure 7.** Advantages of BIM in Design-Build (D&B) Projects.

### 5.2. Scheduling Outcomes: 4D Visual Synchronization

Traditional scheduling relies on Gantt charts, which are abstract and often disconnected from the physical reality of the site.

- *The 7-Days Cycle Optimization:* The 4D BIM simulation allowed the joint venture (Hoa Binh - Agrimeco) to perfect a 7-days erection cycle for the steel frame. By visualizing the sequence of the tower crane movements and material delivery, the team eliminated logical errors in the schedule.

- *Site Logistics:* Discussion revealed that 4D BIM was instrumental in managing the limited staging area at the Ciputra site. The simulation ensured that structural members arrived "Just-in-Time," preventing site congestion and reducing the double-handling of materials, which traditionally accounts for significant hidden costs.

### 5.3. Financial Transparency and 5D Quantity Takeoff

For the owner, Vietinbank Tower, financial control was paramount.

- *Quantity Accuracy:* The 5D BIM model provided an automated quantity takeoff that showed a less than 1 % variance from the actual

fabricated steel tonnage. In contrast, traditional manual takeoffs in Vietnam often carry a 5-10 % contingency error.

- *Automated Valuations:* The model acted as a neutral auditor for progress payments. Subcontractors were paid based on verified digital quantities rather than subjective manual estimates. This minimized disputes between the Owner, the Consultant (Turner), and the Contractors, fostering a more collaborative financial environment.

### 5.4. Collaboration and the "Single Source of Truth"

The project's success in coordination was largely due to the Common Data Environment.

- *International Synchronization:* With design teams in London (Foster + Partners) and management in the USA (Turner), the SharePoint-based CDE served as the bridge. The discussion highlights that RFI (Request for Information) response times were reduced by 30-40 % because technical queries were presented within a 3D spatial context rather than through descriptive text or 2D snapshots.

- *Data Continuity:* Unlike traditional projects where data is "lost" between design and construction, the BIM model ensured that the architectural intent was perfectly translated into fabrication drawings.

### 5.5. Critical Discussion: Barriers and the "EPC Gap"

Despite the clear benefits, the research identifies critical challenges that limited BIM's potential at Vietinbank Tower:

- *Fragmentation of Contracts:* The project did not follow a traditional EPC (Engineering, Procurement, Construction) or Design & Build (D&B) model. Instead, it used multiple separate packages. This led to "information friction," where different contractors had varying levels of BIM maturity. The research suggests that BIM is most effective when managed by a single Lead Total Contractor who can enforce a unified BIM standard across all subcontractors.

- *High Initial Investment*: The discussion notes that the cost of hardware (high-end workstations) and software licenses (Autodesk and Trimble suites) remains a barrier for smaller Vietnamese firms. However, when compared to the 10,267 billion VND total investment, the BIM cost was a marginal percentage that yielded high ROI (Return on Investment) through risk mitigation.

- *The Human Factor*: There is a notable shortage of qualified BIM Managers in the domestic market. The reliance on international experts for high-level management increases project overhead. This highlights an urgent need for Vietnamese universities to integrate BIM into their core engineering curricula.

### 5.6. Synthesis: The Paradigm Shift

The comparison proves that while Traditional PM is sufficient for low-complexity buildings, it is functionally obsolete for super-high-rise projects. BIM-PM transforms management from a reactive stance (fixing mistakes on site) to a proactive stance (optimizing performance in a virtual environment). The Vietinbank Tower serves as a pilot that validates the Vietnam Government's BIM Roadmap, proving that digital integration is the only path toward competing in the global construction market.

### Conclusion

The comparative study of the Vietinbank Tower project proves that BIM-integrated management is vastly superior to traditional methods for complex, high-rise structures. While the "Traditional PM" model is sufficient for low-rise, simple buildings, it fails to provide the accuracy required for modern engineering. BIM transforms the management from a "reactive" to a "proactive" state, ensuring quality, safety, and financial viability.

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