INTEGRATED COST ESTIMATION AND TIME EFFICIENCY IN CONSTRUCTION: A COMPARATIVE STUDY OF BIM AND TRADITIONAL PROJECT MANAGEMENT SOFTWARE

Md. Towfik Hassan*[1], Md. Jahurul Islam[2], B M Sarzil Redwan[3], Md Shafayet Alam[4], Md. Mustakim[5]

[1] *Lecturer, Department of Building Engineering & Construction Management, Rajshahi University of Engineering & Technology, Bangladesh, e-mail: mthassan@becm.ruet.ac.bd*
[2] *Graduate, Department of Building Engineering & Construction Management, Rajshahi University of Engineering & Technology, Bangladesh, e-mail: jahurulislamapon@gmail.com*
[3] *Graduate, Department of Building Engineering & Construction Management, Rajshahi University of Engineering & Technology, Bangladesh, e-mail: bmredwansarzil@gmail.com*
[4] *Graduate, Department of Building Engineering & Construction Management, Rajshahi University of Engineering & Technology, Bangladesh, e-mail: shafayet.alam@ymail.com*
[5] *Graduate, Department of Building Engineering & Construction Management, Rajshahi University of Engineering & Technology, Bangladesh, e-mail: mustakim.fahim1212@gmail.com*

***Corresponding Author**

ABSTRACT

The construction industry in Bangladesh still depends heavily on manual methods such as spreadsheets and paper records for cost estimation and schedule management. These traditional practices often lead to delays, budget overruns, and reduced efficiency, especially at a time when global industries are adopting digital tools like Building Information Modeling (BIM). This study compares Autodesk Revit, a BIM-based platform, with Microsoft Project, a widely used project management tool, to assess which delivers better results for cost and schedule control. Using data from a real residential building project, cost estimates and schedules were developed in both tools and analyzed side by side. The findings show that Revit improved cost estimation accuracy by reducing projected costs by about 9% and shortened project duration by 11 days (3.7%) compared to Microsoft Project. Revit's automated quantity take-offs, early clash detection, and clear visual timelines made planning more efficient and reliable. In contrast, Microsoft Project required manual data entry and lacked built-in coordination features. Overall, the findings suggest that Revit enhances both accuracy and efficiency in cost and schedule estimation, highlighting its potential to improve project outcomes in the Bangladeshi construction sector.

Keywords: *Building Information Modelling, Cost Estimation, Schedule Optimization, Construction Management, 4D/5D Integration.*

1. INTRODUCTION

The residential construction sector in Bangladesh is characterized by rapid growth and chronic project delays. Numerous studies report that most construction projects in Bangladesh suffer from significant time and cost overruns. Implementation monitoring and evaluation reports that major infrastructure and building projects exceed their schedules, often incurring penalties and budget shortfalls. Empirical analyses attribute these delays to a range of factors, including a lack of experienced project management, improper planning and scheduling, funding shortages, and limited skilled labor. There are other common issues include inefficient contract practices as like lowest-bidder selection and resource price escalations (Pandit & Hossain, 2025; Perera & Imriyas, 2004). In practice, these constraints make it difficult to complete projects on time and budget, and also highlighting the need for improved planning and control in the Bangladeshi context.

Despite these challenges, project scheduling is usually handled with conventional tools such as Microsoft Project, which generate two-dimensional Gantt charts of activities and timelines. Such traditional scheduling methods require extensive manual setup and updating of tasks, dependencies, and resources. Moreover, they often support only single-user editing on a desktop computer and hindering real-time collaboration. For instance, without specialized cloud or server support, MS Project is single access only one person can update the schedule at a time, and field teams cannot view or adjust the schedule live. In complex projects, this static approach has well-known limitations. Traditional Gantt-based tools struggle to absorb changes and to integrate design information; as one study notes that they may struggle with dynamic adjustments and real-time optimization in complex construction projects, which can lead to inefficiencies and further delays. The 2D scheduling approach provides limited visualization of the construction process and requires laborious manual maintenance, which can lead the delays with variable aspects (Bui et al., 2016; Perera & Imriyas, 2004). Traditional cost estimation methods, including analogous, parametric, and detailed estimating, are widely recognized for their ease of use, familiarity, and cost-effectiveness. They provide a quick and fairly reliable basis for estimating costs in the initial stages of project planning. However, their accuracy tends to fall short in large or complex projects, where diverse variables and unforeseen factors can greatly affect overall project expenses (Reddy Anireddy, 2024).

On the other hand, projects that adopted BIM throughout the entire lifecycle from design to construction and refurbishment showed notable enhancements in both efficiency and performance. Specifically, such projects achieved up to a 38% reduction in total costs and a 35% decrease in project duration compared to traditional methods. These results highlight BIM’s capability to streamline workflows, minimize rework, and optimize resource utilization across all project phases (Das et al., 2025).

Building Information Modeling (BIM) offers a more integrated approach to planning and execution which creates a centralized digital model that incorporates both the geometry and data of the building project, acting as a collaborative information database. In practice, standard 3D BIM contains the physical and structural details of the project, but it does not by itself include time or cost information. To overcome this, practitioners use 4D BIM, which enriches the model with time. In a 4D BIM workflow, scheduling data like task durations, sequences, start dates etc. are linked to the 3D model elements, allowing the construction process to be simulated step by step. This integration enables visual animation of the building sequence like stakeholders can see each floor’s steel erection or concrete pouring over time as an animated model. In doing so, 4D BIM helps project teams anticipate sequencing conflicts, optimize logistics, and improve communication. Many studies highlight that 4D BIM analysis can improve monitoring stages and reduce the immanent risks by the visual workflows with spatial layouts of components (Fazeli et al., 2021; Haider et al., 2020). Again, by combining the design model with the schedule, 4D BIM can greatly enhance the efficiency of construction planning. Numerous analyses conclude that simulating schedules in this way has a very high potential to improve project management, delivery and to reduce construction errors effectively (Al Shanto et al., 2024; Haider et al., 2020).

Beyond time integration, BIM can also include cost information in a 5D BIM analysis. In 5D BIM, quantities of each model element are linked to unit costs, enabling automatic cost estimating and budget tracking (Das et al., 2025; Fazeli et al., 2021). As designs change, the linked cost databases update project budgets in real time. This provides a clear visualization of how schedule changes or design modifications affect the project's finances. Many researchers evaluate that 5D BIM has a significant power to improve the cost estimation with aligning the task which could be updated in further and control the budget properly as compared to conventional method (Belay et al., 2021; Das et al., 2025).

Another analysis reveals that while traditional cost management practices remain dominant and well-understood, the adoption of 5D-BIM is still limited due to a significant knowledge gap and lack of organizational training. This highlights a crucial industry turning point where integrating BIM into cost management offers great potential but remains underutilized (Safaa Eldin et al., 2024). By contrast, in traditional planning the schedule and cost estimates are often handled separately, which can lead to inconsistencies and manual recalculation errors. With BIM-based 5D integration, project stakeholders can generate quantity take-offs directly from the model, perform rapid cost analyses, and maintain a synchronized schedule and cash flow plan (Fazeli et al., 2021).

In spite of these clear theoretical advantages, the adoption of BIM for scheduling and cost management has been limited in many developing countries. Few empirical studies have evaluated how BIM-based planning actually performs relative to traditional scheduling in on ground projects in Bangladesh or similar settings (Ahamed Bin Ali, 2023; Aljobaly & Banawi, 2020). Most existing research in the Bangladeshi construction literature focuses on identifying delay factors and adoption barriers (Ahamed Bin Ali, 2023; Pandit & Hossain, 2025), but there is a gap in direct, comparative analysis of scheduling tools. Moreover, where 4D/5D BIM studies do exist, they often deal with large or hypothetical projects rather than routine residential construction in a local context. As a result, the potential productivity gains of BIM remain largely unquantified for the typical projects managed by Bangladeshi contractors (Das et al., 2025; Nafe Assafi et al., 2023).

This paper addresses that gap by presenting a case study comparison of Autodesk Revit–based 4D/5D modeling versus conventional MS Project scheduling on a real residential construction project in Bangladesh. The study develops parallel construction schedules: one using Autodesk Revit (with associated 4D/5D extensions) and one using Microsoft Project's Gantt-chart approach. Both schedules are then monitored against actual project progress. The aim is to assess differences in schedule accuracy, progress tracking, and cost estimation between the two methods. By evaluating schedule adherence and effort for each approach, the research provides evidence on the practical benefits and limitations of BIM-enhanced scheduling in the context of Bangladeshi residential construction.

2. METHODOLOGY

This study employed a quantitative, comparative case-study approach using real project data. The case was a five-story residential building in Bangladesh (dimensions 30×53 ft, stories of 10 ft height) designed to BNBC 2020 standards. All architectural and structural drawings (columns, beams, slabs) were collected and used to build a parametric 3D model. The actual construction records (materials, labor, timelines) provided the baseline data. Figure 1 shows the workflow of this study. Building code values (BNBC 2020) governed material and dimension inputs. Task durations and quantities were derived from this design. For the MS Project workflow, quantities were calculated manually using BNBC rules and for the Revit workflow, quantities were extracted automatically from the model. Both approaches began with the same scope and assumptions to ensure a fair comparison.

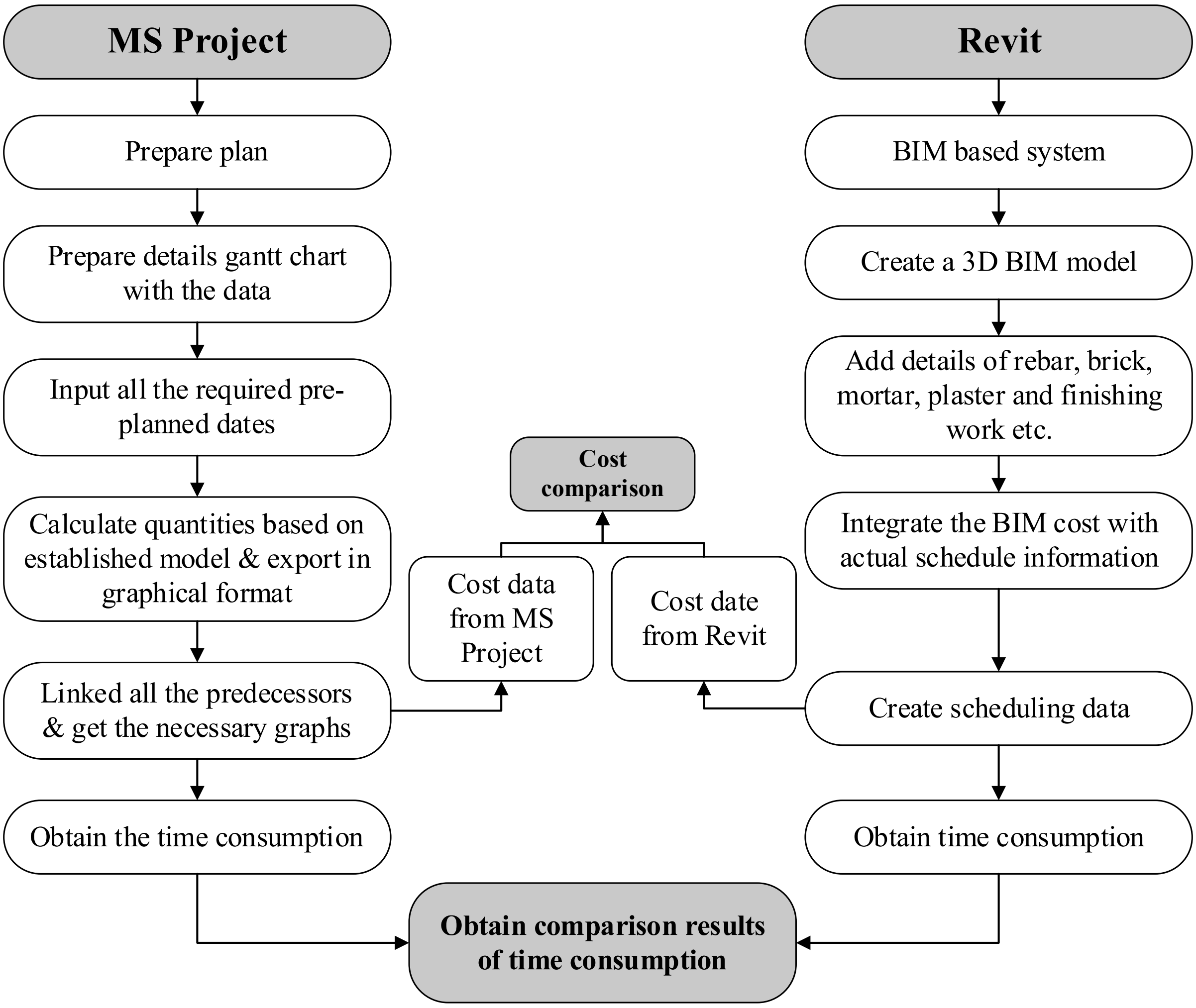

Figure 1: Flow diagram of this study

2.1 Autodesk Revit Workflow

In the BIM-based workflow from Figure 1, Autodesk Revit was used as an integrated design-to-schedule tool. First, the same building was modeled in 3D with all architectural and structural elements (walls, beams, columns, slabs, staircases) as shown in Figure 2. Each element was defined parametrically: dimensions, materials, and other properties were embedded in the model. This enabled automatic quantity takeoff and cost estimation (a 5D BIM process). Revit schedules for wall elements were created with calculated fields, unit cost multiplied by wall area yielded the total material cost. Unit rates were entered directly into the Revit material library, so any change in wall design or area would instantly update the cost. This links design, quantity takeoff, and cost in one environment.

Scheduling was handled via Revit's phasing and linking with time data and the construction phases were assigned to model elements, and a 4D sequence was generated. This allows the 3D model to be played back over time to simulate construction progress. Thus, unlike the static Gantt in MS Project, Revit's model supports interactive 4D visualization. Any design change automatically cascades through to the schedule and cost (true 4D/5D integration). In practice, this means the Revit workflow comprised: "model creation → automated and cost rollout → link to timeline (4D) → output schedule and cash flow". In our case, all model-based quantities and costs were extracted directly, eliminating the separate takeoff step required in MS Project.

Figure 2: Isometric view from Revit

2.2 MS Project Workflow

In the traditional workflow in Figure 3, the project schedule and cost plan were developed in Microsoft Project by manual input. First, all construction activities: excavation, foundation, columns, slabs, finishing, etc. were identified and organized into a WBS. Durations and resource needs (labor, equipment) were estimated for each task based on local practice and code. These inputs were entered manually into MS Project. Dependencies (predecessors/successors) were then linked to build a logical network and auto-generate a Gantt chart. Resources were assigned to each task with their rates, and a baseline cost schedule was produced.

Throughout execution, MS Project continuously updates the schedule when actual progress is entered, highlighting the critical path and any delays. However, MS Project itself does not link to the design model or automatically compute quantities: all cost rates had to be applied separately (using spreadsheets) based on the manual takeoff. This stepwise process reflects the conventional, linear workflow: "quantity takeoff → spreadsheet calculation → MS Project input → schedule". It relies heavily on manual data transfer, which prior studies have noted is prone to duplication and error.

Superstructure	**0 edays**	**84 days**	**ober 23, 2023**	**uary 15, 2024**		
Ground floor slab casting (GB and slab rod binding,suttering and casting)	0 edays	28 days	October 23, 2023	November 29, 2023	8SS+2 days	Aggregate[685 cft] Cement[243 cft], Rebar[4.32 ton], Sand[363 cft]
1st floor slab casting (column,beam and slab rod binding,suttering and casting)	0 edays	28 days	November 30, 2023	January 8, 2024	9	Aggregate[758 cft] Cement[284 cft], Sand[439 cft], Rebar[5.35 ton]
Roof top slab casting (column,beam and slab rod binding,suttering and casting)	0 edays	28 days	January 9, 2024	February 15, 2024	13	Aggregate[758 cft] Cement[284 cft], Sand[439 cft], Rebar[5.35 ton]

Figure 3: Gantt chart from MS Project

2.3 Data Analysis & Comparison

After both models were built, comparable outputs from each workflow were extracted. Key metrics included total construction cost, total duration, and timing of cash flows. The MS Project output provided a baseline schedule and cost report; the Revit model yielded a cost schedule via its schedules and phasing. It is recorded that the quantities of major materials (concrete, steel, brick) and compared them between the two methods. Table 1 summarizes the main workflow differences. The analysis then compared projected budgets and timelines from each tool. Differences in man-hour estimates and potential waste were noted.

- **Comparison Metrics:** Comparing overall schedule lengths, peak resource demands, and cumulative costs over time. 4D sequencing in Revit was evaluated against the MS Project Gantt to identify timing deviations. Material quantities from Revit schedules were benchmarked against manual takeoff figures.
- **Validation:** Whenever possible, outputs were cross-checked with the actual project records. This ground truth helped assess which method gave closer estimates.
- **Integration Assessment:** It is also assessed the degree of data linkage. Revit's 4D/5D integration was noted for enabling immediate re-scheduling upon design change, whereas MS Project required revisiting multiple documents.

By structuring the study this way, the methodology captures both workflows step-by-step and sets up a direct comparison on equal footing. Table 1 encapsulates the core distinctions in approach between the two tools.

Table 1. Comparison of traditional vs BIM workflows.

Feature	MS Project (Traditional)	Autodesk Revit (BIM)
Data Input	Manual task and resource entry; durations estimated from past data.	3D model elements carry geometry and properties automatically (parametric).
Quantity Takeoff	Taken off manually and entered into schedule.	Automated via Revit schedules.
Scheduling (4D)	Gantt-chart scheduling with fixed tasks; no direct link to design.	4D sequence generated by phasing model elements (model ↔ timeline linkage).
Cost Estimation (5D)	Costs manually applied to tasks after takeoff (separate from model).	Costs roll up automatically from model data; unit costs embedded in model.
Change Management	Manual updates across documents required.	Changes propagate through model (quantities and costs auto-update).

In summary, this methodology implemented two parallel planning processes on the same project: a conventional MS Project–based plan and an integrated Revit BIM plan. Both used identical project specifications and inputs. Outputs from each were quantitatively compared (cost totals, schedule length, resource use) to evaluate the time and cost efficiency of BIM-based 4D/5D planning versus traditional methods.

3. RESULTS & DISCUSSIONS

The results are structured to first address MS Project cost and schedule outcomes, followed by Revit-derived cost estimation and schedule performance results. Then, a comparison of these two software programs is highlighted, showing that the 4D/5D BIM analysis is significantly more compatible than traditional analysis. The study concludes with a synthesis of theoretical contributions and a discussion of discrepancies.

3.1 MS Project Derived Costing & Scheduling

The graph in Figure 4 represents the cash flow chart generated from MS Project which presents the cost distribution and progress of the construction project across seven stages (Q1 to Q7), amounting to a total cost of 5,658,898 tk. In the first stage, Q1, which represents the foundation work, the cost is the highest at 969,382 tk, reflecting the heavy investment required for excavation, reinforcement, and concrete works. From Q2 to Q6, corresponding to the successive floor constructions, the expenditure remains fairly consistent, ranging between 850,335 tk and 873,010 tk. This uniformity indicates a steady allocation of resources during the main structural phases of the building. In the final stage, Q7, representing the last floor, the cost reduces sharply to 415,166 tk, highlighting that fewer resources were required for finishing activities compared to earlier stages. The percentage of completion, shown by the orange line, rises progressively with each stage, moving from around 15–20% in Q1 to full 100% completion in Q7. Overall, this chart demonstrates that MS Project reflects higher initial.

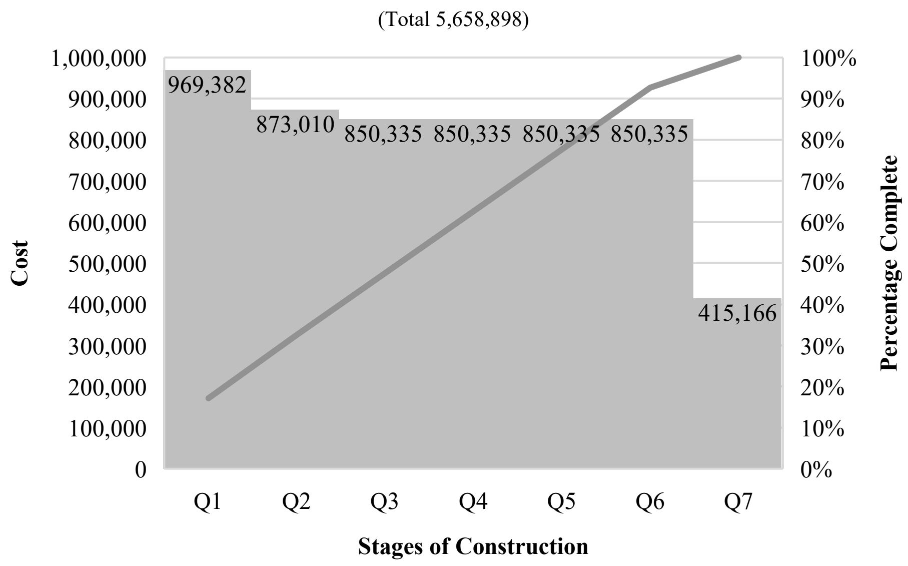

Figure 4: Cash Flow from MS Project

3.2 Revit Derived Costing & Scheduling

Figure 5 represents the cash flow chart represent the distribution of costs and project progress across seven construction stages (Q1-Q7) with total expenditure 5,144,445 tk from Revit.

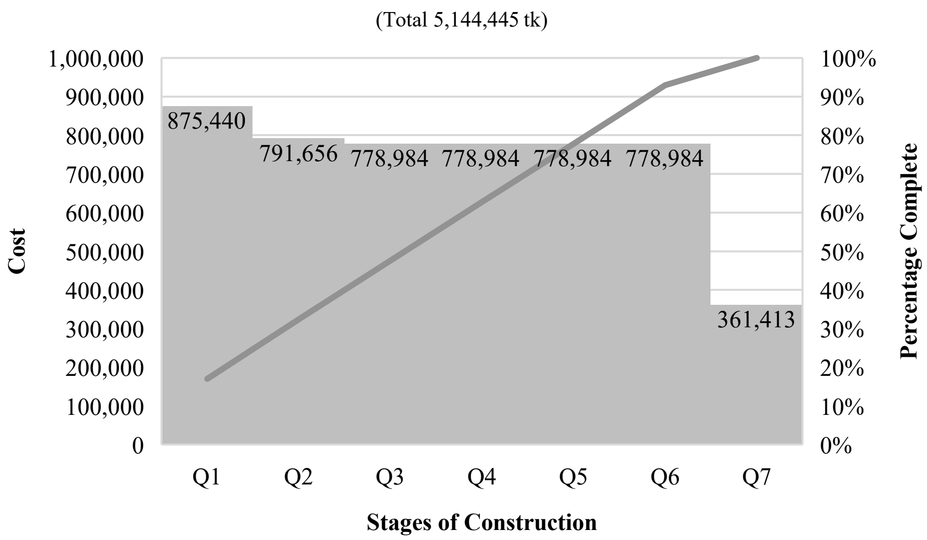

Figure 5: Cash Flow from Revit

In the stage Q1, which represents the foundation work, which show highest cost 875,440 tk for excavation, reinforcement and concrete works. The costs stay comparatively constant at about 778,984 tk per stage from Q2 to Q6, which correspond to the construction of successive floors. This suggests that resources were distributed consistently throughout the building's major structural phases. Because fewer materials and activities are needed in this stage than in previous ones, the cost significantly drops to 361,413 tk in the final stage, Q7, which represents the last floor. Alongside the cost data, the orange line, which shows the project completion percentage, progressively increases from about 15% to 20% in Q1 to 100% completion in Q7. Overall, the chart indicates that the majority of expenditures and advancements are attributed to the foundation and intermediate floor construction, whereas the final phase of the project involves comparatively lower project completion costs.

3.3 Comparison Between Revit & MS Project

From Figure 6, compares cost distribution between Revit and MS Project. MS Project shows a front-loaded approach: 969,382 in Q1 dropping to 873,010 in Q2, reflecting early resource mobilization. The Revit model transitions more smoothly from 875,440 in Q1 to 791,656 in Q2, indicating a more gradual, BIM-driven allocation. From Q3 to Q6, MS Project allocates a flat cost of 850,335 each quarter, implying uniform resource requirements. The Revit model assigns 778,984 per quarter, reflecting lower resource needs and more detailed BIM-based quantity planning. For the project closeout (Q7), MS Project allocates 415,166, a moderate final-phase cost. Revit allocates 361,413 for Q7, lower in absolute terms but proportionally similar, reflecting BIM-based finishing details. The total MS Project cost is 9.1% higher, reflecting different estimation methods. MS Project's higher cost suggests broad risk allowances typical of traditional CPM scheduling, whereas Revit's lower total comes from precise, BIM-based quantity takeoffs. These patterns affect financing that Revit's smoother distribution may improve cash flow management, while MS Project's front-loading aligns with conventional milestone. This comparison shows that tool choice impacts budget forecasting and financial strategy. Revit's integration of geometry and quantities provides granular cost estimates that may reduce uncertainty. MS Project's approach relies on conventional resource mobilization and risk-management practices. The observed 9.1% variance suggests examining each platform's assumptions and scheduling methods to determine which yields more accurate cost forecasts for various project types.

Figure 7 illustrates the comparative analysis of scheduling methodologies, revealing clear differences in project delivery efficiency between MS Project and Revit-based planning. The Revit model achieved a total duration of 289 days, compared to 300 days in MS Project, representing an 11-day reduction or 3.7% improvement in schedule efficiency. This demonstrates that Building Information Modeling integration enhances traditional project scheduling performance. Both scheduling approaches followed typical S-curve progressions, with gradual early progress, accelerated mid-phase activity, and controlled completion stages. However, the Revit model consistently showed higher progress velocity across equivalent time intervals, resulting in faster completion percentages. This efficiency stems from BIM's integration of spatial and geometric data directly into scheduling logic, reducing coordination issues and delays common in two-dimensional methods. Milestone analysis confirmed consistent advantages across all major phases. These sequential improvements compounded throughout the project lifecycle, producing the total 11-day reduction. The consistent pattern across multiple activities indicates systematic enhancement in planning and coordination rather than isolated phase optimizations. The reduced duration also carries practical implications. The compressed schedule contributes to lower general conditions and temporary facility costs, earlier occupancy, and improved cash flow. For contractors, faster completion enhances resource turnover, equipment utilization, and annual project capacity. The demonstrated schedule reduction indicates tangible efficiency benefits achievable through BIM-integrated planning compared to conventional scheduling approaches.

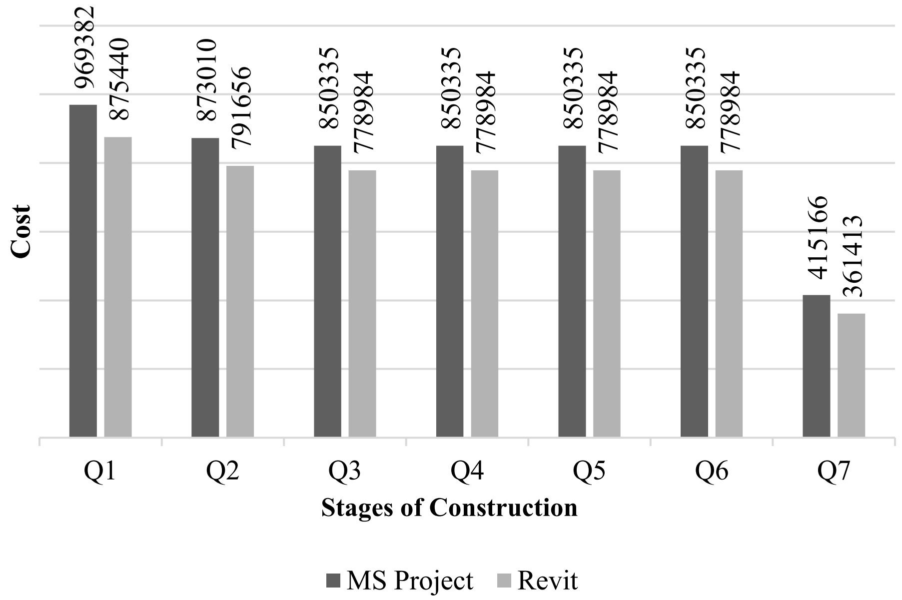

Figure 6: Cost Comparison between Revit & MS Project

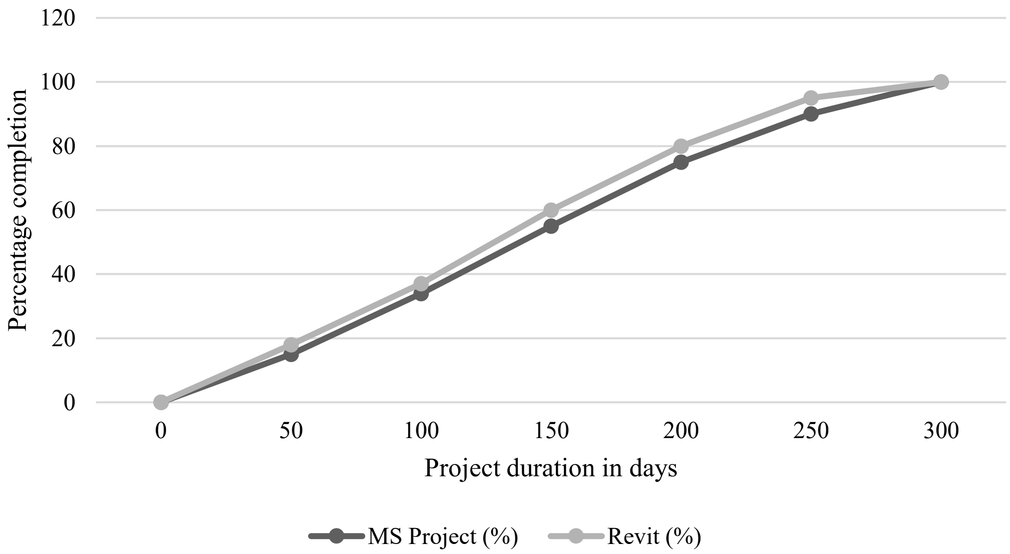

Figure 7: Schedule Comparison Graph

4. CONCLUSIONS

This study showed that Microsoft Office 2021 (Project and Excel) as a traditional tool and Autodesk Revit 2025 as a BIM-based design and scheduling tool compare project schedule and costing more or less effectively. However, the traditional tool has some user difficulties compared to the modern one because of its manual calculation and auto updated issues. According to the comparison study, project cost estimates created with Revit were about 9% less than those created with Microsoft Excel. When it came to scheduling efficiency, the Revit-based method produced a project duration that was roughly 3.7% less than the MS Project timeframe. Furthermore, Revit is cost estimate was more accurate than the MS Excel-based estimate, staying within about 4% of the project's actual costs, with a 12% variance. These enhancements are attributable to Revit is real-time data updates, automated quantity takeoffs, and integrated 4D and 5D features, all of which together offered a substantial benefit over MS Project's restricted interoperability and human data entry.

DECLARATION OF USE OF AI

AI-assisted tools were used only for minor language editing and grammatical improvement, with full author oversight. No AI tools were used in the research design, data analysis, or interpretation of results.

REFERENCES

Ahamed Bin Ali, T. (2023). Scope and Challenges of Implementation of Building Information Modeling (BIM) in Bangladesh. *International Journal of Science and Research (IJSR)*, *12*(4), 1013–1015. https://doi.org/10.21275/sr23413143318

Al Shanto, A., Ananta, A. F., Rahman, M., & Manjur, K. A. (2024). *Bim in Bangladesh's Education System and Construction Industry: Adaptability And Benefits in A Developing Country Context* (pp. 314–332). https://doi.org/10.2991/978-94-6463-478-5_24

Aljobaly, O., & Banawi, A. (2020). Evaluation of the Saudi Construction Industry for Adoption of Building Information Modelling. *Advances in Intelligent Systems and Computing*, *965*, 488–498. https://doi.org/10.1007/978-3-030-20454-9_49

Belay, S., Goedert, J., Woldesenbet, A., & Rokooei, S. (2021). Comparison of BIM Adoption Models between Public and Private Sectors through Empirical Investigation. *Advances in Civil Engineering*, *2021*. https://doi.org/10.1155/2021/5577654

Bui, N., Merschbrock, C., & Munkvold, B. E. (2016). A Review of Building Information Modelling for Construction in Developing Countries. *Procedia Engineering*, *164*, 487–494. https://doi.org/10.1016/j.proeng.2016.11.649

Das, K., Khursheed, S., & Paul, V. K. (2025). The impact of BIM on project time and cost: insights from case studies. *Discover Materials*, *5*(1). https://doi.org/10.1007/s43939-025-00200-2

Fazeli, A., Dashti, M. S., Jalaei, F., & Khanzadi, M. (2021). An integrated BIM-based approach for cost estimation in construction projects. *Engineering, Construction and Architectural Management*, *28*(9), 2828–2854. https://doi.org/10.1108/ECAM-01-2020-0027

Haider, U., Khan, U., Nazir, A., & Humayon, M. (2020). Cost comparison of a building project by manual and BIM. *Civil Engineering Journal (Iran)*, *6*(1), 34–49. https://doi.org/10.28991/cej-2020-03091451

Nafe Assafi, M., Hossain, M. M., Chileshe, N., & Datta, S. D. (2023). Development and validation of a framework for preventing and mitigating construction delay using 4D BIM platform in Bangladeshi construction sector. *Construction Innovation*, *23*(5), 1255–1278. https://doi.org/10.1108/CI-08-2021-0160

Pandit, A., & Hossain, G. M. A. B. (2025). Challenges and Barriers to Implementing Building Information Modeling (BIM) in the Architectural Practice in Bangladesh. *International Journal of Innovative Science and Research Technology*, 2664–2691. https://doi.org/10.38124/ijisrt/25apr1564

Perera, A. A. D. A. J., & Imriyas, K. (2004). An integrated construction project cost information system using MS AccessTM and MS ProjectTM. *Construction Management and Economics*, *22*(2), 203–211. https://doi.org/10.1080/0144619042000201402

Reddy Anireddy, A. (2024). Comparative Analysis of Traditional vs. Modern Estimating Methods: Pros and Cons of Different Approaches in Construction. *International Journal of Science and Research (IJSR)*, *13*(11), 1–5. https://doi.org/10.21275/sr241023231113

Safaa Eldin, A. M., Abdelalim, A., & Tantawy, M. (2024). Enhancing Cost Management in Construction: The Role of 5D Building Information Modeling (BIM). *Engineering Research Journal*, *183*(3), 226–251. https://doi.org/10.21608/erj.2024.377303