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A Comparative Analysis of SaaS-based BIM Viewers: Functional Evolution and Strategic Directions for the Japanese Construction Industry

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Abstract

Although the introduction of SaaS-based BIM viewers is progressing in the construction industry, international studies that systematically compare, across multiple products, the concrete state of functional implementation and the directions of technological evolution remain insufficient. In this study, we targeted a total of 16 products (12 international products and 4 Japanese products). We intensively collected, during December 2025, information that can be verified by third parties, including publicly available primary sources such as official websites, user manuals, technical blogs, and API documentation. Using these sources, we conducted a comparative analysis based on an original functional evaluation framework consisting of four categories: Basic function, BIM management, Task management, and Construction management. As a result of the analysis, a particularly large gap was confirmed in BIM management functions: the average score of international products was 6.3, whereas that of Japanese products was 1.3. International products tend to position BIM as the core of the CDE (Common Data Environment) and to expand capabilities such as version management and clash detection, thereby evolving into an integrated management platform that supports project-wide coordination. By contrast, Japanese products tend to deepen their capabilities as construction site digital transformation (DX) tools that support practical on-site operations such as safety and quality management. By presenting a reproducible evaluation framework together with empirical results, this study provides strategic implications for the Japanese construction industry on how to simultaneously pursue short-term efficiency improvement and long-term investment in data utilization.

Keywords

Building Information Modeling (BIM), BIM viewer, Cloud computing, Software as a Service (SaaS), Japan

Type: Research Article

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1. Introduction

1.1. Research background and motivation

In the construction industry, the diffusion of Building Information Modeling (BIM) technologies and the integration of Software as a Service (SaaS) platforms have been advancing rapidly. In Cassandro et al.'s review, which classified more than 15,000 BIM-related papers published between 2013 and 2023 into ten categories, technologies that can be categorized as SaaS are highlighted as cloud-based collaboration and real-time collaborative work enabled by cloud technologies, particularly within the three domains of innovative construction technologies, collaboration and communication, and interoperability and standards (Cassandro et al., 2024). This trend is also evident in Japan. According to a survey by the Ministry of Internal Affairs and Communications, Information and Communications

Bureau (2023), the cloud service adoption rate in Japan's construction industry reached 87.7%, which greatly exceeds the average across all industries (77.5%). This empirical figure objectively indicates that the construction sector in Japan is proactively adopting cloud technologies. Because SaaS is generally based on a multi-tenant model that provides standardized functionality to a large number of companies (Abdul et al., 2018), systematically analyzing the functions that major SaaS product groups provide can be regarded as an effective approach for broadly grasping the issues and use cases that are commonly demanded on construction sites.

In recent years, as a core function for promoting collaboration among stakeholders involved in construction projects, many construction SaaS products have begun to incorporate a BIM viewer. In Ivson et al.'s systematic review of visualization technologies used in BIM, as many as 248 applications were identified, indicating strong demand and a broad range of potential applications in this domain (Ivson et al., 2020). However, when focusing on the Japanese market, major domestic construction SaaS companies began providing BIM viewers only relatively recently, from 2021 onward (Appendix A). This temporal gap suggests the possibility that, compared with overseas markets, the functions offered by products and the use cases that are realized on site may be more limited. For Japan's construction industry, where the labor force continues to shrink due to demographic change, improving productivity through BIM utilization is an unavoidable issue. Accordingly, as a means of addressing this issue, enhancing the functional maturity of SaaS-based BIM viewers and expanding their scope of practical use on construction sites are urgent tasks.

1.2. Limitations of prior research

Existing research concerning SaaS-based BIM viewers used at construction sites has predominantly consisted of individual case studies that examine the impacts and benefits of introducing a particular product in a specific context. For instance, studies have reported the rationalization and streamlining of design change management processes using Autodesk Construction Cloud (Hiba & Saoud, 2024), the cost reduction effects achieved through clash or interference detection using Trimble Connect (Checca et al., 2025), and communication improvements realized via a Unity-based augmented reality (AR) application (Chernick et al., 2021).

These prior studies are valuable in that they demonstrate the effectiveness of individual tools. However, because they are limited to specific products, a unified criterion for objectively evaluating technological trends across the market as a whole has not been established. As a consequence, three challenges remain: (1) a lack of clarity regarding the functional comprehensiveness and coverage of the overall SaaS-based BIM viewer market, (2) the difficulty of objective comparisons across products, and (3) obstacles to systematically theorizing and explaining patterns of technological development. By overcoming these limitations of prior research and conducting a comprehensive analysis that takes a market-wide perspective, this study aims to fill the gap that remains in this research field.

1.3. Research objectives and contributions

The objective of this study is to empirically clarify the internationally standard functions of SaaS-based BIM viewers and their directions of development through a comprehensive comparative functional analysis targeting 16 major products across Japan, the United States, and Europe. On this basis, the study seeks to present concrete guidance that can contribute to advancing BIM utilization on Japanese construction sites and, ultimately, to improving productivity. The academic and practical contributions expected from this study are summarized below.

As an academic contribution, first, this study aims to elucidate the overall functional landscape of SaaS-based BIM viewers. By overcoming the limitations inherent to individual case studies and conducting a systematic functional comparison of 16 major products across Japan, the United States, and Europe, the study empirically demonstrates the overall functional landscape of SaaS-based BIM viewers and the current state of the market, which have not been sufficiently clarified in prior work. Second, this study constructs an objective evaluation framework. By providing such a framework, objective product comparisons and analyses of patterns of technological evolution become feasible, and a reproducible common foundation can be offered for future related studies.

As a practical contribution, the evaluation framework constructed in this study and the results of the comparative analysis can serve as an objective decision-making guideline for construction practitioners when selecting tools that fit their organizational issues and operational needs. At the same time, for software vendors, the findings provide insights that can support the formulation of development strategies informed by global technology trends and the status of competing products. Ultimately, the study aims to contribute to raising the overall level of BIM utilization in Japan's construction industry and to addressing the pressing challenge of productivity improvement.

2. Methodology

In this section, in order to systematically clarify the international functional characteristics of SaaS-based BIM viewers, we adopt a comparative case study approach. In particular, to evaluate the existence and the level of functions objectively and with high reproducibility, we draw on a scoring method used in international comparative research on BIM protocols (Ishizawa et al., 2018). The analytical process of this study was implemented by iteratively carrying out three processes: (1) selecting the target products, (2) collecting data based on publicly available information, and (3) constructing and refining the evaluation framework.

2.1. Selection of target products

To ensure the validity of the international comparison, this study selected the target SaaS-based BIM viewers through purposive sampling. Unlike random sampling, purposive sampling is a method in which cases rich in information are intentionally chosen in alignment with the research objective, and it is well suited to this study, which seeks to analyze representative market trends in depth. In the selection process, the following three criteria were applied.

1. **Representativeness in the market:** In each of the North American, European, and Asian (Japan) markets, the product is one that has, in principle, approximately 100,000 or more users. Furthermore, on G2—an independent software evaluation platform that aggregates more than 50,000 verified user reviews submitted by users from over 100,000 companies—the product must have an overall rating score of 3.5 or higher.
2. **Consistency of functional focus:** The product must be a SaaS whose primary functions are clearly positioned as supporting collaboration on construction sites, with the BIM model explicitly placed at the center of such collaboration. Accordingly, CDE products that do not include a BIM viewer as a function are not included in the target set.
3. **Openness and verifiability of information:** Information such as functional specifications, technical manuals, and API documentation must be disclosed on official websites or equivalent sources, such that third parties are able to verify the information. In addition, to ensure objectivity in the comparison, data collection was conducted intensively during a specific period (December 2025).

Based on the above criteria, we selected a total of 16 products: 12 international products that are widely used in the global market (e.g., Autodesk Construction Cloud, Trimble Connect, and Dalux) and 4 Japanese products that have developed characteristics unique to the Japanese market (e.g., Photoruction and ANDPAD). Through this selection, we constructed a representative sample set with minimal bias that enables an objective comparative analysis of both global technology trends and the distinctiveness of the Japanese market.

2.2. Developing an analytical framework to enable objective evaluation

To systematically and objectively compare and analyze the diverse functional data that were collected, this study constructed an original Functional Evaluation Framework for SaaS-based BIM viewers. To achieve both theoretical validity and comprehensiveness, the framework was developed via the following two-stage approach.

Top-down approach (theory-driven):

Based on prior studies (Kreider & Messner, 2013; Ivson et al., 2020), we first defined the major evaluation categories (evaluation axes) that reflect construction-site workflows, such as construction planning, construction management, progress management, and safety and quality management. By doing so, we ensured the theoretical foundation of the analysis.

Bottom-up approach (data-driven):

Next, we carefully reviewed all functional data collected from the 16 products and inductively extracted and organized specific sub-items (evaluation items) that are classified under the major categories. Through this step, we ensured that the framework covers up-to-date functions present in the market, including functions that are not fully captured by existing theories alone.

Table 2.1. SaaS-based BIM viewer functional evaluation framework

Category	Overview	Feature Examples
Basic function	Common core functionalities provided by BIM viewers	Viewer, Properties, Filter , Measure,Section
BIM management	BIM model management capabilities	VersionManagement, Grouping, ClashDetection
Task management	Stakeholder communication features	Tasks, BCF support, Safety/Quality Management
Construction management	Comprehensive management functions such as progress tracking and cost control	Progress management, Cost management

Based on this framework, we evaluated the extent to which each product satisfies individual functional items using vendors' publicly available primary information according to the following four levels. Importantly, the subject of evaluation in this study is not the mere presence or absence of implementation itself, but rather documented capabilities that can be verified through publicly available primary information and therefore can be replicated by third parties.

− (Not Supported): No description of the function is found in public primary sources; existence cannot be confirmed.
+ (Documented / Present): The function's existence can be objectively confirmed from public primary sources.
++ (Advanced Data Structuring): In addition to "+," the function supports project operations through structured information (e.g., linkage to BIM object IDs) and/or advanced search and filtering, indicating higher operational maturity.
+++ (Automated / Integrated): In addition to "++," the function demonstrates automation (e.g., AI-based analysis such as image analysis or automated clash-related processes), rule-based automatic processing, and/or advanced data integration with external systems (e.g., via APIs), indicating more autonomous and advanced operations.

Through this analysis, we visualize the common functional sets and the advanced functions found in internationally prevalent products, as well as the characteristics and functional differences of Japanese products. By doing so, we identify the current technical position of SaaS-based BIM viewers in Japanese construction sites and, at the same time, derive implications that can inform future development.

3. Results

In this section, based on the Functional Evaluation Framework for SaaS-based BIM viewers defined in the previous section, we report the results obtained from the comparative functional analysis of the 16 target products, consisting of 12 international products and 4 Japanese products. The results are presented from two perspectives: (1) the overall implementation status across functional categories, and (2) a comparison of functional characteristics between international and Japanese products.

3.1. Overall implementation status across functional categories

First, for all 16 products, we analyzed to what extent functions classified into four categories (Basic function, BIM management, Task management, and Construction management) can be confirmed in publicly available primary information. Table 3.1 aggregates, for representative functions included in each functional category, how many of the 16 products can be confirmed as supporting the functions through publicly available primary information (i.e., with an evaluation of '+' or higher). For detailed evaluation results for each of the 16 products, refer to Appendix A.

Table 3.1. Implementation status of major functions (N = 16)

Category	Features	Deployments	Implementation rate
Basic function	Viewer	16	100%
	Properties	16	100%
	Filter	16	100%
	Measure	16	100%
	Section	16	100%
	Walkthrough	15	94%
	Save Viewpoint	15	94%
	Markup	15	94%
	Third-party service integration	16	100%
BIM management	Version Management	10	63%
	Object Grouping	14	88%
	Clash Detection	11	69%
	Point Cloud	5	31%
	360° Photo	3	19%
	AR/VR/MR	7	44%
	DataCheck/ IDS	6	38%
Task management	Tasks	10	63%
	BCF support	9	56%
	Safety Management	10	63%
	Quality Management	13	81%
Construction management	4D/ Progress management	10	63%
	Quantity takeoff	3	19%
	5D/ Cost management	1	6%
	6D/ Environment management	1	6%

The analysis confirmed that Basic function is supported, according to publicly available primary information, by all products, indicating that it constitutes a minimum common set of functions demanded by the market. On the other hand, various functions related to BIM management and Task management were confirmed for more than half of the products, suggesting that these function sets are likely becoming standardized and may be increasingly expected as de facto standard functions.

3.2. Comparison of functional characteristics between international and Japanese products

Next, we divided the products into two groups—international products (12 products) and Japanese products (4 products)—and compared the degree of emphasis by functional category.

We converted each functional evaluation to a score (+++: 3 points, ++: 2 points, +: 1 point, -: 0 points) and calculated the average score per product for each category. Table 3.2 shows the results of the calculation.

Table 3.2. Average category scores: international vs. Japanese products

Category	A.International products average score(n=12)	B.Japanese products average score(n=4)	Gap (A-B)
Basic function	10.2	8.5	1.7
BIM management	6.3	1.3	**5.1**
Task management	4.5	1.8	2.8
Construction management	1.7	1.3	0.4
Overall average	5.7	3.2	2.5

From these results, the following tendencies are identified.

Commonalities:

With respect to both the Basic function set and the Construction management set, the differences from international products are small, indicating that Japanese products provide functions at approximately the same level. For Construction management, the average scores are low to begin with, and both international and Japanese products can be regarded as being in a developing stage.

Differences:

For BIM management, Japanese products show a markedly different tendency in functional maturity that can be confirmed through publicly available primary information. In particular, Version management—whose support was confirmed (through publicly available primary information) in nearly 70% of international products—should be usable for three Japanese products because they are based on Autodesk Platform Services (APS). Nevertheless, we could not confirm promotion or documentation of this capability in publicly available primary information. The same situation applies to Clash detection, which was confirmed (through publicly available primary information) in half of the international products.
For Task management, while international products tend to cover the relevant functions broadly and evenly, Japanese products exhibit differences that are not visible from the above average scores, in that they focus only on Quality Management.

In summary, both international and Japanese products show some commonality in BIM viewer utilization for on-site construction management. However, in terms of comprehensive management of BIM itself, substantial differences in functional implementation were observed. Overall, Japanese SaaS-based BIM viewers can be characterized as being in a developing stage even for functions that appear as common functions in the market.

4. Discussion

In this section, based on the analytical results presented in the previous section, we discuss the factors that may lie behind the functional differences between international and Japanese products and examine the implications that these differences may have for the Japanese construction industry.

4.1. Divergent development trajectories behind functional differences

The most pronounced difference identified in this study—namely, the gap in BIM management functions—reflects a fundamental difference in product development philosophy regarding how BIM is positioned and utilized within a project.

Development philosophy of international products:

As project integrated management platforms, international products tend to regard BIM as the core of the CDE (Common Data Environment) and to expand their functions as platforms that integrate project-wide workflows and promote data-driven decision-making. Functions such as version management and clash checking, as discussed in studies such as Hiba & Saoud (2024) and Checca (2025), can be understood as embodying this development philosophy.

Furthermore, in OpenSpace's Progress management, 360-degree photos are used to present the degree of progress by employing a Spatial AI Engine, and in FlyPaper (Procore)'s Clash Detection, AI-driven model detection functions are used to analyze interference locations, thereby accelerating analytical work through AI technologies. Such AI-enabled functional development is noteworthy in that international products appear to be transitioning from a stage where humans primarily view BIM to a stage where AI extracts differences and supports analysis.

Development philosophy of Japanese products:

In contrast, Japanese products specialize in Task management as construction site DX tools and are accepted as communication and report creation tools aimed at improving consensus building and the efficiency of quality records on site. Demand for comprehensive management functions for BIM models themselves has not yet become explicit, and products are optimized for solving specific on-site problems. This interpretation is also supported by the fact that, although major Japanese products should be able to leverage BIM management functions because they are based on APS, such functions are not visibly promoted in publicly available primary information. In other words, Japanese products can be characterized as focusing on reducing the effort required for humans to create reports.

4.2. Implications for Japan and future directions

This divergence in development paths and development philosophies provides important implications for deepening BIM utilization in the Japanese construction industry. First, the value of Japanese products as construction site DX tools is a strength that directly contributes to productivity improvement under conditions of a shrinking labor force, and this direction should continue to be developed. In particular, functions that use AI technologies to automatically process construction site data and to enable its accelerated utilization—similar to those that have begun to appear in international products—hold substantial potential for future development.

Second, however, the lack of a perspective on BIM utilization as a project integrated management platform—which represents an international trend—may become a medium- to long-term risk. To maximize the value of BIM, companies will need broader BIM strategies that prevent data from becoming siloed and that anticipate data utilization across the entire project lifecycle. This point also provides an important implication for Japanese SaaS products in the context of potential overseas expansion in the future.

4.3. Contributions, limitations, and future work

This study makes an academic contribution by quantitatively demonstrating, for the first time, the overall functional landscape of SaaS-based BIM viewers and the differences in development paths by market. In addition, the study can be expected to provide practical contributions in that it offers objective guidelines for tool selection to practitioners and provides strategic implications to vendors when considering product development directions.

The limitations of this study lie in the small sample size and in the fact that the analysis is based solely on publicly available information. As future prospects, we consider expanding the sample size, elucidating the actual demand structure through user interviews regarding functions used in practice, and conducting fixed-point observations of market changes over time. Moreover, because some cases already show the beginning of AI technology utilization within existing functions, we also aim to advance the typology and classification of such AI utilization patterns.

5. Conclusion

This study aimed to gain insights into the direction that the Japanese construction industry should pursue by comparing the functions of 16 SaaS-based BIM viewer products in Japan and overseas. In this section, we summarize the study as a whole and present the main conclusions and the contributions of this research.

5.1. Summary and conclusions

This study quantitatively clarified that there is a remarkable difference between international products and Japanese products in terms of management functions for BIM models. The conclusion derived from this result is that there are two clear directions in the technological development of SaaS-based BIM viewers. While international products are evolving into integrated management platforms that handle project-wide information, Japanese products are specializing as construction site DX tools that support on-site communication and related operations.

In light of this divergence in development paths, it is essential for the Japanese construction industry to balance short-term problem solving aimed at improving current operational efficiency with future-oriented investment that anticipates data utilization across the entire project lifecycle.

5.2. Contributions and future outlook

The contribution of this study lies in systematically presenting, for the first time, the overall landscape of SaaS-based BIM viewers, international technology trends, and Japan's current position in a research field that has previously been dominated by individual case studies. In practical terms, these results provide guidelines that can support tool selection by practitioners and can also inform development strategy formulation by vendors.

Based on the limitations of this study, future research topics include elucidating the actual demand structure through user interviews regarding functions used in practice, as well as further research on structuring and categorizing the utilization of AI that was observed in some cases. We expect that this study will contribute to the further advancement of BIM utilization and to productivity improvement in the Japanese construction industry.

Declaration of competing interests

The author declares that there is no conflict of interest regarding the publication of this paper.

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Appendix

Appendix A

Outline	Contry	USA	USA	USA	USA	USA	UK	Germany	Switzerland	Austria	Norway	Denmark	Netherlands	Japan	Japan	Japan	Japan
	Products	International Product A	International Product B	International Product C	International Product D	International Product E	International Product F	International Product G	International Product H	International Product I	International Product J	International Product K	International Product L	Japanese Product A	Japanese Product B	Japanese Product C	Japanese Product D
Outline	Contry	USA	USA	USA	USA	USA	UK	Germany	Switzerland	Austria	Norway	Denmark	Netherlands	Japan	Japan	Japan	Japan
	Products	International Product A	International Product B	International Product C	International Product D	International Product E	International Product F	International Product G	International Product H	International Product I	International Product J	International Product K	International Product L	Japanese Product A	Japanese Product B	Japanese Product C	Japanese Product D
	Release Year of BIM Viewer	2016	2016	2014	2017	2020	2014	2009	2012	2019	2018	2005	2023	2023	2021	2021	2024
	UserNumber	2,000,000> (2023)	-	10,000,000> (2020)	371,000> (2025)	-	350,000> (2025)	500,000> (2023)	260,000> (2024)	170,000> (2025)	81,000> (2025)	1,700,000> (2025)	150,000> (2025)	75,555> (2024)	-	160,000> (2025)	684,000> (2025)
	G2 Score (2025.12)	4.4	4.4	4.9	4.5	4.4	3.8	4.3	4.6	4.3	3.5	4.6	4.5	-	-	-	-
Basic function	Viewer	3	1	2	1	1	2	1	2	1	2	2	2	1	1	1	1
	Properties	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
	Filter	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Measure	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Section	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Walkthrough	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Save Viewpoint	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1
	Markup	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1
	Third-party service integration	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BIM Management	Version Management		2	2	1	1	2		1	1	2	1	1				
	Object Grouping	3	2	2	1	1	2	1			1	1	1	1	1	1	1
	Point Cloud	2	1	2	1	1			2	1	1	2	1				1
	360° Photo	1			3	2				1		1					
	AR/VR/MR			2			1		2								
	Clash Detection	3	2	1	1		1		1				1				
	DataCheck/ IDC	2	1	2			3				1		1				
Task Managment	Tasks	1	2		1	2	2		1	1	1	1	1				
	BCF support		1	3			1	1	2	1	2	2	1				
	Safety Management		2	1	1	2	2	1	1		1	2	1				
	Quality Management	1	2	1	1	2	1	1	1		1		2		2	3	2
Construction Management	4D/ Progress management	2	1	1	3			1	2		2			1		2	2
	Quantity takeoff		2					2			+						
	5D/ Cost management							2									
	6D/ Environment management							2									