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Understanding Customer Satisfaction in BIM-Based Digital Construction Services: A B2B Marketing Perspective

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Abstract

Purpose

This study examines the determinants of customer satisfaction in BIM-based digital construction services within a Business-to-Business (B2B) context. While prior research has primarily focused on technology adoption and implementation barriers, limited attention has been given to post-adoption satisfaction and value realization among AEC professionals.

Methodology

Grounded in the Technology Acceptance Model and perceived value theory, the study investigates the influence of perceived usefulness, perceived ease of use, training and technical support, cost perception, and perceived return on investment (ROI) on customer satisfaction. A quantitative cross-sectional survey was conducted with 150 BIM users in the National Capital Region (NCR). Multiple regression analysis was employed to test the proposed relationships, controlling for professional experience, role, and duration of BIM usage.

Findings

The results indicate that perceived ROI is the strongest predictor of customer satisfaction, followed by perceived usefulness and training and technical support. Perceived ease of use has a smaller but significant influence, while cost perception does not significantly affect satisfaction.

Originality/Value

The study extends technology acceptance research by shifting the focus from adoption intention to post-adoption satisfaction in BIM-enabled digital construction services within a B2B environment.

Keywords: *Building Information Modeling (BIM), Customer Satisfaction, B2B Services, Digital Transformation, Perceived Value.*

Introduction

The construction industry is undergoing rapid digital transformation, with Building Information Modelling (BIM) emerging as a central technology in modern project management. BIM enables integrated digital representations of physical and functional building characteristics, facilitating coordination, visualization, and lifecycle management across Architecture, Engineering, and Construction (AEC) stakeholders. Beyond improving technical efficiency, BIM increasingly functions as a strategic digital service within Business-to-Business (B2B) construction ecosystems. BIM has been widely recognized for improving coordination, visualization, and project efficiency in construction management

(Azhar, 2011).BIM also supports integrated digital representation of building information across project life cycles (Borrmann et al., 2018).

Although the technical and operational benefits of BIM have been widely documented, existing research has predominantly focused on adoption barriers, implementation challenges, and technological capabilities. Far less attention has been given to post-adoption outcomes, particularly customer satisfaction from a B2B marketing perspective. In professional construction markets, satisfaction plays a critical role in sustaining long-term client relationships, encouraging repeat engagement, and strengthening competitive positioning. Understanding what drives satisfaction in BIM-based services is therefore essential for both academic development and managerial practice.

Digital transformation in construction requires more than technological deployment; it demands value realization. Organizational clients evaluate BIM not only in terms of system usability but also through measurable performance improvements, service support quality, and financial returns. However, empirical evidence examining how these value dimensions influence customer satisfaction remains limited, especially in emerging market contexts.

Addressing this gap, the present study investigates the determinants of customer satisfaction in BIM-based digital construction services among AEC professionals in the NCR region. Drawing on Technology Acceptance Model (TAM) and perceived value theory, the study examines the influence of perceived usefulness, perceived ease of use, training and technical support, cost perception, and perceived return on investment (ROI) on customer satisfaction.

By reframing BIM as a marketed digital service rather than merely a technical innovation, this study contributes to bridging digital construction management and B2B marketing literature, offering both theoretical advancement and practical guidance for value-driven digital transformation strategies.

Research Objectives

Objective 1

To examine the impact of perceived usefulness on customer satisfaction in BIM-based digital construction services.

Objective 2

To assess the influence of perceived ease of use on customer satisfaction.

Objective 3

To analyse the effect of training and technical support on customer satisfaction.

Objective 4

To evaluate the impact of cost perception and return on investment (ROI) perception on customer satisfaction.

Objective 5

To determine the overall explanatory power of perceived value and service-related factors in predicting customer satisfaction.

Literature Review

Building Information Modeling (BIM) has increasingly been conceptualized not merely as a technological innovation but as a digitally enabled service ecosystem embedded within broader construction management processes (Zhou et al., 2024; Yang et al., 2021). As the construction industry advances toward data-driven and integrated project delivery models, scholarly attention has shifted from adoption-centric perspectives to post-adoption value realization and performance evaluation (Visartsakul & Damrianant, 2023). The Technology Acceptance Model (TAM) provides an important theoretical foundation by positing perceived usefulness and perceived ease of use as central determinants of technology evaluation (Venkatesh et al., 2020). The Technology Acceptance Model (TAM) originally proposed by Davis (1989) explains how perceived usefulness and perceived ease of use influence user evaluation of technology. However, contemporary research suggests that these constructs extend beyond initial acceptance and continue to influence post-implementation satisfaction, particularly in professional B2B contexts where system performance directly affects operational outcomes (Hussain et al., 2022). Complementing TAM, perceived value theory argues that organizational customers evaluate digital services through a cost–benefit calculus in which return on investment (ROI) and measurable efficiency gains become dominant determinants of satisfaction (Eggert et al., 2020; Dou et al., 2021). In

technology-intensive industries, satisfaction is further shaped by relational and service-support mechanisms, as continuous training and technical assistance facilitate effective capability development and value co-creation (Tang et al., 2023). In B2B markets, customer satisfaction is closely linked to perceived value created through the balance between benefits and sacrifices (Eggert & Ulaga, 2002).While cost perception may influence pre-adoption decision-making, emerging evidence indicates that once digital solutions are integrated into workflows, perceived economic benefits and functional utility exert stronger effects on evaluative judgments than price considerations alone (Wang & Li, 2022). Despite growing recognition of these theoretical dimensions, limited empirical research integrates technology acceptance, perceived value, and service support perspectives to explain customer satisfaction in BIM-based digital construction services. By synthesizing these frameworks, the present study contributes to advancing theoretical understanding of post-adoption satisfaction within B2B digital transformation environments.

Conceptual Framework

Based on the preceding literature, this study conceptualizes BIM-based digital construction services as a multidimensional B2B digital service offering in which technological performance, economic value realization, and service-support mechanisms jointly determine customer satisfaction. While prior BIM research has predominantly emphasized technological adoption and operational efficiency, the present framework positions BIM as a strategic digital service ecosystem evaluated by organizational clients through functional, usability, economic, and support-related dimensions.

The proposed model suggests that five core determinants — perceived usefulness, perceived ease of use, training and technical support, cost perception, and perceived return on investment (ROI) — directly influence customer satisfaction in BIM-enabled B2B construction environments.

Perceived usefulness reflects the extent to which BIM enhances project coordination, visualization, efficiency, and risk mitigation. In high-risk and capital-intensive construction settings, improvements in functional performance significantly shape clients' evaluations of digital service effectiveness.

Perceived ease of use captures the usability dimension of BIM platforms, representing the degree to which systems are accessible, intuitive, and adaptable to existing workflows. Systems that reduce complexity and learning effort are expected to positively influence satisfaction outcomes.

Training and technical support represent the service-support dimension of the BIM ecosystem. In digital construction services, ongoing assistance, structured onboarding, and troubleshooting support facilitate effective system utilization and enhance the overall service experience.

Perceived return on investment (ROI) reflects the economic value realization dimension. Given the substantial financial investment associated with BIM implementation, organizational clients evaluate digital services based on measurable cost savings, efficiency gains, and performance improvements.

Cost perception represents the sacrifice component within the value evaluation process. Although high perceived cost may negatively influence satisfaction, its impact may vary depending on the extent to which benefits are realized.

Accordingly, the proposed model conceptualizes customer satisfaction as a cumulative evaluative response shaped by functional performance, usability, economic return, and service support within a B2B digital construction context.

Hypotheses Development

H1: Perceived usefulness has a significant positive impact on customer satisfaction in BIM-based digital construction services.

H2: Perceived ease of use has a significant positive influence on customer satisfaction.

H3: Training and technical support have a significant positive effect on customer satisfaction.

H4: Perceived cost burden has a significant negative impact on customer satisfaction.

H5: Perceived return on investment (ROI) has a significant positive influence on customer satisfaction.

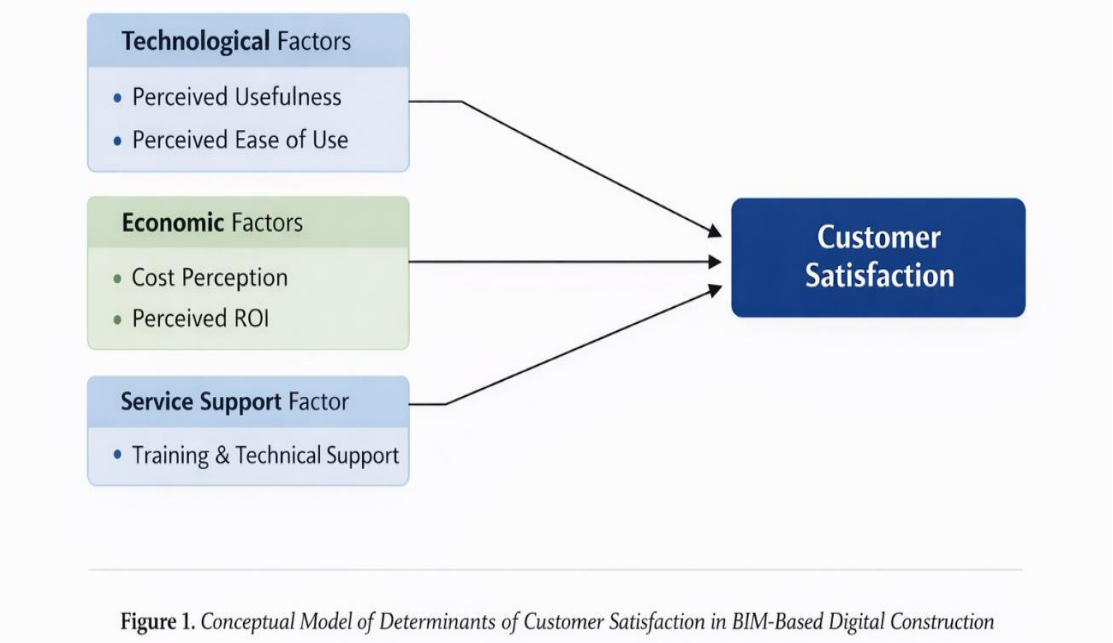

Figure 1. *Conceptual Model of Determinants of Customer Satisfaction in BIM-Based Digital Construction*

Research Methodology

- **Research Design**

This study adopts a quantitative research design to examine the determinants of customer satisfaction in BIM-based digital construction services. A cross-sectional survey approach was employed to collect primary data from professionals engaged in BIM-enabled projects. The quantitative method was considered appropriate as the objective of the study was to test hypothesized relationships between multiple independent variables and customer satisfaction using statistical techniques.

The research design is explanatory in nature, aiming to identify and evaluate the influence of technological, economic, and service-support factors on satisfaction outcomes within a Business-to-Business (B2B) construction context.

- **Population and Sampling**

The target population comprised Architecture, Engineering, and Construction (AEC) professionals who actively use Building Information Modelling (BIM) in digital construction projects. These respondents represent organizational clients who evaluate BIM as a strategic digital service within their firms.

A total of 150 respondents participated in the study. The sample was selected using a simple random sampling technique to ensure equal probability of inclusion among eligible participants. The sample size is statistically adequate for multiple regression analysis involving five predictors, exceeding commonly recommended minimum thresholds for reliable estimation.

The respondents included architects, engineers, project managers, and contractors with practical experience in BIM implementation within the National Capital Region (NCR).

- **Measurement of Constructs**

The study employed structured measurement scales adapted from established literature in technology acceptance, perceived value, and service marketing research. All items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The key constructs measured in the study include:

  - **Perceived Usefulness (PU):** Reflects the extent to which BIM enhances project efficiency, coordination, and performance outcomes.

- **Perceived Ease of Use (PEOU):** Captures the degree to which BIM platforms are perceived as user-friendly and easy to integrate into workflows.
- **Training and Technical Support (TTS):** Represents the availability and effectiveness of onboarding assistance, troubleshooting support, and technical guidance.
- **Cost Perception (CP):** Reflects respondents' evaluation of the financial burden associated with BIM implementation.
- **Perceived Return on Investment (ROI):** Measures the extent to which BIM generates measurable economic and operational benefits.
- **Customer Satisfaction (CS):** Conceptualized as the overall evaluative response of AEC professionals toward BIM-based digital construction services.

- **Control Variables**

To account for potential demographic and professional influences on customer satisfaction, three control variables were included in the regression analysis: years of professional experience, professional role, and duration of BIM usage. These variables were incorporated to ensure that the observed relationships between the independent variables and customer satisfaction were not confounded by background characteristics of respondents.

Data Analysisand Results

The data analysis was conducted in three stages.

- First, reliability analysis using Cronbach's alpha was performed to assess the internal consistency of the measurement constructs.
- Second, Pearson correlation analysis was conducted to examine the relationships among variables and to assess potential multicollinearity concerns.
- Third, multiple linear regression analysis was performed to test the proposed hypotheses and evaluate the impact of perceived usefulness, perceived ease of use, training and technical support, cost perception, and perceived ROI on customer satisfaction.

Customer satisfaction was treated as the dependent variable, while the remaining constructs were entered as independent variables. The regression model assessed the explanatory power (R^2), statistical significance, and standardized coefficients to determine the relative strength of each predictor.

Reliability Analysis

To assess the internal consistency of the measurement scales, Cronbach's alpha coefficients were calculated for each construct.

The results indicated strong reliability for Perceived Usefulness ($\alpha = 0.921$), Perceived Return on Investment ($\alpha = 0.870$), and Customer Satisfaction ($\alpha = 0.927$), demonstrating excellent internal consistency. Perceived Ease of Use showed acceptable reliability ($\alpha = 0.621$), while Training and Technical Support exhibited moderate reliability ($\alpha = 0.559$), which may be attributed to the limited number of items measuring the construct.

Overall, the reliability results confirm that the measurement scales were suitable for further inferential analysis.

Correlation Analysis

Pearson correlation analysis was conducted to examine the relationships among the study variables. The results indicated positive correlations between perceived usefulness, perceived ease of use, training & support, ROI perception, and customer satisfaction. Cost perception showed a comparatively weaker association with satisfaction.

The absence of excessively high inter-correlations among independent variables suggests that multicollinearity was not a concern.

Multiple Regression Analysis

To test the proposed hypotheses, multiple linear regression analysis was performed with Customer Satisfaction as the dependent variable and Perceived Usefulness, Perceived Ease of Use, Training & Technical Support, Cost Perception, and ROI Perception as independent variables.

Model Fit

The overall regression model was statistically significant:

- $R^2 = 0.777$
- Adjusted $R^2 = 0.769$
- $F = 100.1$
- $p < 0.001$

The model explains approximately **77.7% of the variance in customer satisfaction**, indicating strong explanatory power.

Hypothesis Testing Results

H1: Perceived Usefulness → Customer Satisfaction

Perceived usefulness had a significant positive impact on customer satisfaction ($\beta = 0.257$, $p < 0.001$).

H1 is supported.

This indicates that when AEC professionals perceive BIM as improving visualization, coordination, and project efficiency, their satisfaction levels increase significantly.

H2: Perceived Ease of Use → Customer Satisfaction

Perceived ease of use showed a positive and significant effect on customer satisfaction ($\beta = 0.116$, $p = 0.014$).

H2 is supported.

Although the effect size is smaller than other predictors, ease of use contributes positively to overall satisfaction.

H3: Training & Technical Support → Customer Satisfaction

Training and technical support demonstrated a significant positive effect on customer satisfaction ($\beta = 0.192$, $p < 0.001$).

H3 is supported.

This finding highlights the importance of post-adoption service support in enhancing customer experience in BIM-based digital services.

H4: Cost Perception → Customer Satisfaction

Perceived cost burden did not have a statistically significant effect on customer satisfaction ($\beta = 0.011$, $p = 0.571$).

H4 is not supported. This suggests that cost concerns alone do not directly determine satisfaction once BIM has been adopted.

H5: ROI Perception → Customer Satisfaction

Perceived return on investment emerged as the strongest predictor of customer satisfaction ($\beta = 0.410$, $p < 0.001$).

H5 is supported.

This result indicates that economic value realization plays a dominant role in shaping satisfaction levels among AEC professionals.

Key Findings

- ROI perception is the strongest determinant of satisfaction.
- Perceived usefulness significantly enhances satisfaction.
- Training and support are critical service-related drivers.
- Ease of use plays a supportive but smaller role.
- Cost perception does not significantly influence satisfaction.

Strategic Interpretation

The findings indicate that satisfaction in BIM-based digital construction services is primarily value-driven rather than price-driven. AEC professionals prioritize measurable performance outcomes and return on investment over initial cost considerations.

This reinforces the importance of value communication, service support, and economic justification in B2B digital marketing strategies within the construction sector.

Discussion

The present study examined the determinants of customer satisfaction in BIM-based digital construction services from a B2B marketing perspective. The findings provide important theoretical and practical insights into digital value realization within the AEC sector.

- **Perceived Usefulness and Customer Satisfaction**

The results indicate that perceived usefulness significantly influences customer satisfaction. This finding aligns with the **Technology Acceptance Model (TAM)**, which posits that perceived usefulness is a primary driver of favourable attitudes toward technology adoption. However, unlike traditional TAM studies that focus on adoption intention, this study extends the framework by demonstrating that perceived usefulness continues to influence post-adoption satisfaction.

From a marketing standpoint, this suggests that value realization—not merely adoption—is central to long-term digital success. In B2B contexts, organizational customers evaluate technologies based on performance outcomes such as improved visualization, coordination, and efficiency. When these functional benefits are realized, satisfaction increases.

- **Perceived Ease of Use**

Perceived ease of use also demonstrated a significant positive effect on customer satisfaction, although its impact was comparatively smaller than perceived usefulness. This finding supports TAM's proposition that ease of use enhances perceived value and user experience.

In digital service marketing, ease of use reflects service convenience and usability. While important, ease of use appears secondary to economic and performance-based value in the professional AEC environment. This suggests that for experienced professionals, functionality and returns matter more than simplicity alone.

- **Training and Technical Support**

Training and technical support significantly enhanced customer satisfaction. This finding aligns with **service quality theory** and B2B relationship marketing literature, which emphasize the importance of post-adoption support in sustaining customer relationships.

In digital transformation contexts, technology implementation is rarely self-sufficient. Continuous learning, troubleshooting assistance, and integration guidance are critical to value realization. This confirms that BIM should be marketed not merely as software, but as a comprehensive service ecosystem.

- **Cost Perception**

Interestingly, perceived cost burden did not significantly influence customer satisfaction. This contradicts conventional assumptions that high costs reduce satisfaction.

One explanation may be that once adoption occurs, professionals shift focus from initial investment concerns to performance outcomes. This finding supports **perceived value theory**, which argues that customers evaluate offerings based on a trade-off between benefits and costs. If benefits are substantial, cost concerns diminish.

This result reinforces the idea that in B2B digital markets, value justification is more influential than price sensitivity.

- **Perceived ROI as the Strongest Predictor**

Perceived return on investment emerged as the strongest determinant of customer satisfaction. This finding extends B2B marketing literature by demonstrating that economic value realization is central to satisfaction in digital innovation contexts.

In construction management, where projects involve high capital investment and risk exposure, ROI perception directly influences strategic evaluation of technology. The dominance of ROI in predicting

satisfaction suggests that BIM adoption must be framed as a financially strategic decision rather than merely a technological upgrade.

Theoretical Contribution

This study contributes to literature in three ways:

- It extends TAM from adoption intention to post-adoption satisfaction.
- It integrates B2B marketing perspective into digital construction research.
- It highlights economic value realization (ROI) as a dominant determinant of digital satisfaction in professional service environments.

By repositioning BIM as a marketed digital service rather than a purely technical tool, the study bridges the gap between technology management and marketing theory.

Managerial Implications

The findings provide actionable insights for BIM vendors, consultants, and construction firms operating in digital transformation environments.

- **Emphasize ROI-Based Marketing Communication**

Since ROI emerged as the strongest predictor of satisfaction, BIM providers should focus on quantifiable financial benefits in their marketing strategies. Case studies, cost-saving demonstrations, lifecycle efficiency metrics, and performance analytics should be central to value communication.

- **Position BIM as a Value-Driven Service Ecosystem**

The significance of perceived usefulness indicates that performance-based messaging should highlight:

  - Improved coordination
  - Reduced errors
  - Faster project delivery
  - Risk mitigation

BIM should be positioned as a strategic management tool rather than merely a design software.

- **Strengthen Training and Technical Support Infrastructure**

Training and support significantly influence satisfaction. Therefore:

  - Vendors should invest in structured onboarding programs.
  - Continuous learning modules should be offered.
  - Dedicated technical assistance teams should be available.

In B2B markets, after-sales support is a key driver of long-term relationship building.

- **De-emphasize Price Competition**

Since cost perception did not significantly influence satisfaction, competing primarily on price may not be effective. Instead, firms should compete on value creation, strategic alignment, and performance outcomes.

- **Support Digital Capability Development**

Construction firms should view BIM adoption as part of broader digital capability development. Organizational commitment, internal skill enhancement, and leadership support are necessary to translate perceived value into realized satisfaction.

Conclusion

This study examined the determinants of customer satisfaction in BIM-based digital construction services from a B2B marketing perspective among AEC professionals in the NCR region. Moving beyond traditional adoption-focused research, the study investigated how perceived value, service support, cost perception, and economic return influence post-adoption satisfaction in a digital construction management context.

The findings reveal that customer satisfaction in BIM adoption is primarily value-driven. Perceived return on investment emerged as the strongest determinant of satisfaction, followed by

perceived usefulness and training & technical support. Perceived ease of use demonstrated a smaller but significant influence, while cost perception did not significantly affect satisfaction. These results indicate that AEC professionals evaluate BIM not merely as a technical tool, but as a strategic investment whose value must be justified through measurable performance and financial outcomes.

The study contributes to both marketing and management literature by extending the Technology Acceptance Model beyond initial adoption to post-adoption satisfaction. By integrating B2B marketing principles with digital construction management, the research highlights that sustained digital transformation depends on value realization, service ecosystem support, and economic justification rather than price sensitivity alone.

From a strategic perspective, the results suggest that BIM vendors and construction firms should emphasize ROI communication, structured training systems, and performance-based value demonstration. Positioning BIM as a strategic digital service rather than a standalone software solution is essential for enhancing customer satisfaction and long-term digital maturity within the AEC industry.

Overall, the study reinforces the idea that in the digital age, successful technology implementation requires a shift from technology-centric thinking to customer-centric value management. Future research may extend this model using larger and multi-regional samples, incorporate longitudinal analysis, or explore additional variables such as organizational culture and digital readiness to further enrich understanding of digital transformation in construction management.

Limitations and Future Research

This study has certain limitations that should be acknowledged. First, the cross-sectional design captures perceptions at a single point in time; future research may adopt longitudinal approaches to examine how satisfaction evolves as BIM usage matures. Second, the sample was limited to AEC professionals in the NCR region, which may restrict generalizability. Expanding the study to multiple regions or international contexts would enhance external validity. Third, although key determinants such as perceived usefulness, ease of use, ROI, cost perception, and service support were examined, other factors—such as organizational culture, digital readiness, and leadership support—may also influence satisfaction in digital construction environments. Finally, future studies may extend the model by incorporating outcomes such as customer loyalty or by applying advanced analytical techniques to explore more complex relationships.

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Declaration

Declaration of Originality

The authors declare that this manuscript is an original work and has not been previously published, nor is it currently under consideration for publication elsewhere in any form. The study has been conducted independently and reflects the genuine academic work of the authors.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Author Contributions

Anita Tripathi and Dr. Aditi Jain contributed equally to the conceptualization, research design, data analysis, interpretation of results, and manuscript preparation. Both authors participated in drafting and revising the manuscript and approved the final version for submission.

Data Availability Statement

The data used in this study are available from the corresponding author upon reasonable request for academic purposes.

Ethical Statement

Participation in the survey was voluntary, and informed consent was obtained from all respondents. All responses were kept confidential and used solely for academic research purposes.

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