



Parametric Building Information Modelling (BIM) for project delivery optimization in United Kingdom's retail architecture to enhance user experience

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Abstract

This study poses a simple but powerful question in a world where retail establishments are more than just places to shop; they are settings that influence how people feel, move, and interact: What if design could listen? This dissertation explores how parametric Building Information Modelling (BIM), a rule-based, adaptive digital design method, can revolutionize project delivery in UK retail architecture by integrating something often overlooked: human experience.

Through a mixed-methods approach combining surveys, interviews, this research uncovers a critical disconnect between the potential of digital tools and how they're used in practice. While parametric BIM promises flexibility, efficiency, and scalable rollout, its ability to respond to real-time user feedback remains vastly underutilized.

Findings show that customers crave intuitive layouts, better lighting, and spaces that feel right, and professionals increasingly agree. Yet technological skill gaps, organizational resistance, and lack of client awareness continue to slow adoption. However, when parametric BIM is applied with intention, as depicted in Tesco's data-driven rollout, the outcomes speak volumes: faster builds, reduced errors, and spaces that resonate with their users.

This study proposes a roadmap for integrating customer feedback into parametric workflows, switching to dynamic environments from static blueprints shaped by those who use them. In doing so, it reframes parametric BIM not just as a design tool, but as a bridge between data and emotion, efficiency and empathy.

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نمذجة معلومات البناء البارامترية (BIM) لتحسين تسليم المشاريع في بنية البيع بالتجزئة في المملكة المتحدة لتعزيز تجربة المستخدم

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تجارة التجزئة، نمذجة معلومات البناء، نموذج معلومات المباني، الأساليب المختلطة، البناء البارامترية	تطرح هذه الدراسة سؤالاً بسيطاً لكنه بالغ الأهمية في عالم باتت فيه متاجر التجزئة أكثر من مجرد أماكن للتسوق؛ فهي بيئات تؤثر في مشاعر الناس وحركتهم وتفاعلمهم: ماذا لو كان التصميم قادراً على الاستماع؟ تستكشف هذه الأطروحة كيف يمكن لنمذجة معلومات المباني البارامترية ((BIM، وهي منهجية تصميم رقمية تكيفية قائمة على القواعد، أن تحدث ثورة في تنفيذ المشاريع في مجال هندسة متاجر التجزئة في المملكة المتحدة، وذلك من خلال دمج عنصر غالباً ما يُغفل عنه: التجربة الإنسانية. من خلال منهجية بحثية تجمع بين الاستبيانات والمقابلات، يكشف هذا البحث عن فجوة جوهرية بين إمكانات الأدوات الرقمية وكيفية استخدامها عملياً. فبينما تعد نمذجة معلومات المباني البارامترية بالمرونة والكفاءة وقابلية التوسع، إلا أن قدرتها على الاستجابة لتعليقات المستخدمين في الوقت الفعلي لا تزال غير مستغلة بشكل كافٍ. تُظهر النتائج أن العملاء يتوقعون إلى تصميمات بديهية وإضاءة أفضل ومساحات تُشعرهم بالراحة، وهو ما يتفق عليه المهنيون بشكل متزايد. ومع ذلك، لا تزال فجوات المهارات التقنية والمقاومة التنظيمية ونقص وعي العملاء تُعيق تبني هذه المنهجية. مع ذلك، عندما يُطبق نمذجة معلومات المباني البارامترية بوعي، كما يتضح في تطبيق شركة تيسكو القائم على البيانات، فإن النتائج تتحدث عن نفسها: سرعة أكبر في البناء، وتقليل الأخطاء، ومساحات تتناغم مع احتياجات المستخدمين. تقترح هذه الدراسة خارطة طريق لدمج ملاحظات العملاء في سير العمل البارامترية، والتحول من المخططات الثابتة إلى بيئات ديناميكية تُصاغ وفقاً لطلبات المستخدمين. وبذلك، تُعيد الدراسة تعريف نمذجة معلومات المباني البارامترية ليس فقط كأداة تصميم، بل كجسر يربط بين البيانات والعاطفة، والكفاءة والتعاطف.

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Introduction

To remain competitive in the UK retail construction industry, which is at a turning point, digital innovation and customer-centric design must be integrated (Azhar, 2011). Due to fragmented communication, uneven design rollout, and a lack of user feedback integration, traditional delivery techniques frequently fall short (Arayici, 2011). Even while Building Information Modelling (BIM) is becoming more popular in the UK, particularly because of public sector mandates, the more sophisticated and adaptable parametric BIM approach is still not well-known in the retail industry. Delivery speed, cost effectiveness, and responsiveness can all be significantly increased with parametric BIM's automated, rule-based design modifications that can strike a balance between standardization and site-specific requirements.

However, the majority of current research ignores BIM's ability to incorporate real-time user insights into design processes in favor of concentrating on its technical features, such as clash detection and lifecycle management (Eastman C. T., 2011). Parametric workflows rarely incorporate user feedback or post-occupancy evaluations, and when they do, they are frequently viewed as incidental. This highlights a significant knowledge gap regarding the active integration of user experience into parametric BIM-driven retail project delivery. (Wong, 2015)

By examining how parametric BIM can be used to both standardize and expedite the delivery of UK retail outlets and dynamically incorporate customer feedback, this dissertation seeks to close that gap. To create retail settings that are both effectively constructed and truly in line with customer expectations, it will provide a framework where user input serves as a variable within the parametric design logic.

1.1 The role of Parametric BIM in Retail Architecture

By explicitly integrating explicit design logic, rules, algorithms, and weighted parameters, into the digital model, parametric BIM expands upon conventional building information modelling. This goes far beyond static 3D representations in the context of retail architecture: complex canopy geometries, custom display fixtures, and façades with variable panel sizes can all be controlled by underlying scripts that react in real-time to inputs (such as daylight levels, structural limitations, branding guidelines, etc.). The complete model updates, accompanied by documentation, cost estimates, and MEP routing, are performed without requiring a human rewrite when a designer modifies a single parameter, such as panel curvature or module spacing. (Lee, Sacks & Eastman, 2015) (Lee, 2015)

In the UK, parametric workflows (such as Grasshopper for Rhino and Dynamo for Revit) significantly accelerate design exploration in retail fit-out and new-built projects, where branding, circulation patterns, and visual merchandising demands are constantly evolving. In just a few minutes, early-stage choices can be created, providing stakeholders with instant visual input on everything from alternate display bay arrangements to various façade perforation patterns. (Burry, 2011) Additionally, coordination between the structural, mechanical, and architectural disciplines is streamlined: schedules, annotations, and clip-on support immediately update when a parametric wall changes to make room for new ductwork, minimizing the number of collision detection cycles. (Rutten, 2007)

Additionally, performance-led decision-making becomes essential: lighting arrays, acoustic baffles, and solar-responsive shading devices can all be parametrically optimized for energy efficiency and consumer comfort. In addition to reducing design cycles, this automated intelligence helps ensure uniformity across schedules, drawings, and facility-management databases that follow. (Smith, 2012)

1.2 Challenges in UK Retail Architecture Project Delivery

Short lead times, brand compliance, and strict cost constraints are some of the particular delivery pressures faced by retail projects in the UK. Although parameter-driven BIM shows promise, it also presents a distinct set of operational issues:

- **Skill Gaps in Parametric Tools:** Many practitioners lack visual scripting or coding expertise, leading teams to outsource or rely on basic parametric setups, which increases project time and cost (Succar, 2009) (Arayici, 2011).
- **Integration with Traditional BIM Workflows:** Embedding parametric scripts into Revit or CAD can disrupt standard workflows, causing confusion, version issues, and manual rework (Eastman C. T., 2011) (Lee, 2015).
- **Data Management and Standardization:** Inconsistent parametric families and lack of classification standards hinder data quality and smooth collaboration across project stages (Giel, 2015) (Succar, 2009).
- **Cost and Time Constraints:** Developing parametric assets requires upfront time and resources, often seen as a cost rather than a long-term investment, limiting adoption (Azhar, 2011) (Arayici, 2011)
- **Interoperability and Exchange:** Teams may have to manually rebuild content if parametric models are shared across platforms due to script failures or logic loss, which would decrease productivity. (Rankin, A study on the interoperability of BIM platforms in AEC projects, 2017) (Wong, 2015).

2.0 Literature Review

Local marketplaces gave way to Complex, technologically advanced retail spaces in the UK during the last century. This transition reflects global economic dynamics, urbanization, and broader shifts in consumer expectations (Historic England, 2023) (Royal Institute of British Architects, 2021). Innovation in retail design has been fueled by the need for improved user experience, brand consistency, and flexibility in urban environments (Sparks, Emerald Group Publishing).

Building Information Modelling (BIM), particularly parametric BIM, is a significant factor in this shift. Parametric BIM offers dynamic, rule-based design generation, which enables higher response to site-specific limitations and user needs, whereas traditional BIM supports coordination and lifecycle management (Burry, 2011) (Eastman C. T., 2011). In the retail industry, where scalable yet regionally tailored solutions are needed, this is essential (Taghipourarasteh M., 2021).

User experience is now given top priority in retail settings, with an emphasis on ambience, comfort, and brand alignment (Hudson, 2022). By encouraging a user-centered approach and incorporating post-occupancy data and consumer feedback into design revisions, parametric BIM can help with this (Oxman, 2021). Nonetheless, there is still a lack of data on how parametric BIM enhances end-user experiences in retail settings (Zarei, 2021).

This analysis identifies current knowledge gaps to direct future research while critically examining the role of parametric BIM in optimizing the execution of retail projects in the UK with an emphasis on flexibility, efficiency, and user involvement.

2.1 Building Information Modeling (BIM)

An intelligent, data-driven approach for developing and maintaining digital representations of a built asset's functional and physical attributes throughout its lifecycle is called Building Information Modelling (BIM) (Bolpagni M. C., 2021). BIM combines geometric and non-geometric data, including quantities, costs, environmental performance, and maintenance plans, into a centralized 3D model, in contrast to traditional CAD, which creates discrete 2D drawings. By serving as a "single source of truth," this model promotes multidisciplinary cooperation between architects, engineers, contractors, and facility managers, minimizing data silos and enhancing coordination (British Standards Institution, 2021).

To avoid problems before construction starts, modern BIM platforms enable early-stage analysis, including clash detection, 4D scheduling, 5D cost estimation, and simulations for energy, lighting, and thermal performance (Volk, 2022). With metadata integrated to assist facilities management, BIM covers the entire asset lifecycle, from design and construction to operation, renovation, and decommissioning (Zanni M. A., 2020). By providing structured nomenclature, data management rules, and the use of Common Data Environments (CDEs) to assure consistent information sharing, international standards like ISO 19650 have further formalized BIM operations (International Organization for Standardization, 2018).

Through integrated, data-driven decision-making processes, BIM is increasingly essential to the digital transformation of the AEC industry, providing greater accountability, sustainability, and efficiency (World Economic Forum, 2023)

2.2 What is the history of BIM?

(Gerber, 2022) (Volk, 2022) (Ghosh, 2023)

Period	Development	Key Tools / Trends
1990s–2000s	Commercialization of 3D BIM with geometry-data integration	Revit (2002), Archicad, Navisworks
2010s	Standardization & adoption in the public sector (e.g., UK Level 2 BIM mandate)	PAS 1192, later replaced by ISO 19650, federated models.
2020–Present	Integration of BIM with digital twins, parametric design, and open standards	IFC, COBie, Rhino, Dynamo, Autodesk Tandem, generative tools
Ongoing Trends	Emphasis on lifecycle management, AI-enhanced modelling, and BIM-GIS convergence	ISO 19650-3, FM data embedding, City Information Modelling (CIM), AI for clash detection and energy analysis.

2.3 What are the objectives of BIM?

Table 1 Aims or BIM (D. J., 2022) (de Souza, 2024) (Park J. K., 2023)

Benefit	Description
Enhance Collaboration	Create a shared digital model accessible to all stakeholders to reduce errors, omissions, and rework. This promotes real-time updates and coordination (Gerber & Lin, 2022).
Improve Predictability	Enable 4D (time) and 5D (cost) simulations to better forecast construction timelines and budgets, increasing planning accuracy (de Souza et al., 2024).
Drive Performance	Integrate analysis tools for energy, daylight, and structural efficiency early in design to optimize outcomes and reduce lifecycle impacts (Park et al., 2023).
Support Lifecycle Management	Embed asset metadata into models to support long-term facility operation, maintenance, and asset tracking across the lifecycle (UK BIM Alliance, 2022).

2.4 BIM in the Design Phase

BIM facilitates conceptual massing studies and performance assessments throughout the initial stages of the design process. Designers can connect form to energy simulations, daylight metrics, or solar exposure (Reinhart, 2000). As the model develops, parametric rules are encapsulated in

component libraries, or "families" structural grids adapt to floorplate changes, and window sizes adapt to façade modules, automating plan, section, and schedule documents (Eastman C. T., 2011).

Federated models facilitate coordination: systems like Navisworks or Solibri allow architectural, structural, and MEP disciplines to import their specialized models, which are then used iteratively for collision detection and issue tracking. This minimizes construction delays and lowers onsite RFI rates by up to 30% (Azhar, 2011). Integrated cost take-offs and 4D sequencing are also advantageous for detailed design; modifications to geometry instantly update linked cost databases and Gantt charts, facilitating quick value engineering and stakeholder approval.

2.5 What tools are used in BIM?

For building design, standard BIM authoring tools include Autodesk Revit, Graphisoft ArchiCAD, and Bentley AECOsim. For steel and concrete details, Tekla Structures is used. Additionally, Rhino and Grasshopper are utilized for advanced geometry. Autodesk Navisworks, Solibri Model Checker, and BIM 360 are essential tools for coordination and quality assurance/quality control (QA/QC) (Autodesk Inc., 2022). Additional functionality is added by analysis plugins, such as Ladybug/Honeybee (environmental) and Insight 360 (energy), as well as scripting environments like Python and Dynamo (Arayici, 2011).

2.6 What are the benefits of BIM?

Table 2 Benefits of BIM (Gerber, 2022) (de Souza, 2024) (Gane, 2020)

Benefit	Description	Impact
Clash Reduction	Automated clash detection between building systems	Reduces design conflicts by up to 60%
Time Savings	4D scheduling links time with models for better sequencing	Speeds up project delivery by ~20%
Cost Control	5D cost modelling integrates budget tracking with design	Improves budget accuracy by 10–15%
Quality & Safety	Site simulations support better logistics and health & safety reviews	Enhances onsite safety and reduces rework
Sustainability	Early-stage energy and daylight simulations inform design decisions	Reduces energy use by up to 25%
Waste Reduction	Material take-offs and prefabrication reduce onsite waste and environmental impact	Improves sustainability and waste management
Lifecycle Value	Embedded metadata supports Facilities Management (FM) and asset performance	Reduces O&M costs by ~10% over lifecycle

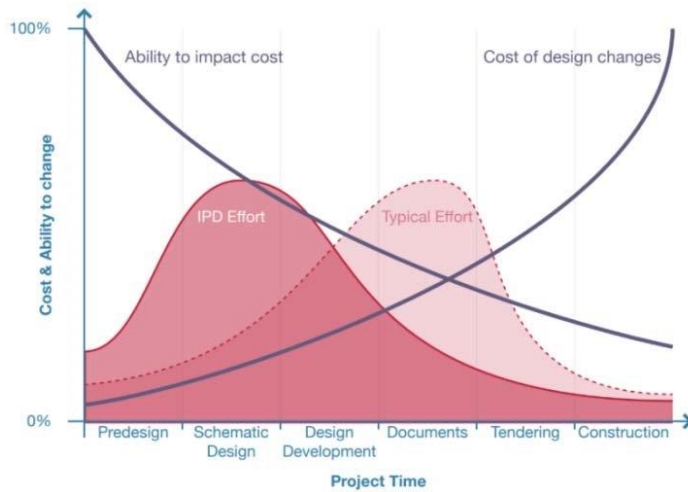


Figure 1 Comparison of Integrated Project Delivery (IPD) Effort vs. Typical Effort across Project Phases, showing cost of design changes and ability to impact cost over time. (Taghipourarasteh E. , 2021)

2.7 What is Parametric Design?

A computational method called parametric design defines relationships between design elements using parameters, which are numerical inputs, rules, and constraints. Designers modify these factors to dynamically change the entire model rather than drafting it by hand (Peters, 2021). As a result, form and performance become interconnected in an adaptive system that enables data to affect materials, structure, and environmental behavior (Gane, 2020)

Teams can effectively investigate design options with this method's support for rapid iteration using sliders, algorithms, or datasets (Gerber, 2022). Parametric templates in retail architecture preserve brand identity while modifying layouts to accommodate various size limitations and regional laws (Raviprakash, 2023).

Parametric design enables the creation of responsive, performance-oriented retail settings that meet user-focused, regulatory, and commercial objectives by combining flexibility and data intelligence.

Table 3 Functions of Parametric Design (Gerber, 2022) (Gane, 2020) (Raviprakash, 2023)

Feature	Function	Benefit in Retail Architecture
Rule-Based Modelling	Uses parameters to define relationships between components	Auto-updates geometry, reducing manual edits (Peters, 2021)
Real-Time Iteration	Adjust models using sliders, algorithms, or input datasets	Enables fast design exploration and client feedback (Gerber & Lin, 2022)
Adaptive Templates	Allows standardization with flexibility	Supports brand consistency across varied retail sites (Raviprakash & Chokkalingam, 2023)
Data-Driven Design	Integrates environmental and spatial data	Optimizes performance, layout efficiency, and customer experience (Gane & Haymaker, 2020)

2.8 History of Parametric Design

With the introduction of computer-aided design (CAD) in the 1960s and 1970s, the foundation for parametric design was laid. Rule-based systems were alluded to in early studies, such as Alexander's "Pattern Language" (1977) (Alexander, 1977). Still, genuine parametric modelling did not emerge until the 1980s when pioneers like Charles Eastman linked geometry to relational (Eastman C. M., 1975). More sophisticated rule sets were made possible in the 1990s with the introduction of node-based scripting by specialized tools like Bentley's Generative Components and early Rhino plug-ins (Davis, The parametric revolution in architecture, 2007). Graph iSOFT GDL language, Autodesk Revit's Dynamo, and McNeel's Grasshopper for Rhino were among the popular authoring tools that adopted visual scripting in the 2000s, introducing parametric techniques into routine architectural practice. Due to demands for digital fabrication, performance analysis, and rapid iterations, the parametric design had transformed from a specialized computational studio to a core capacity in many businesses by the 2010s (Burry, 2011).

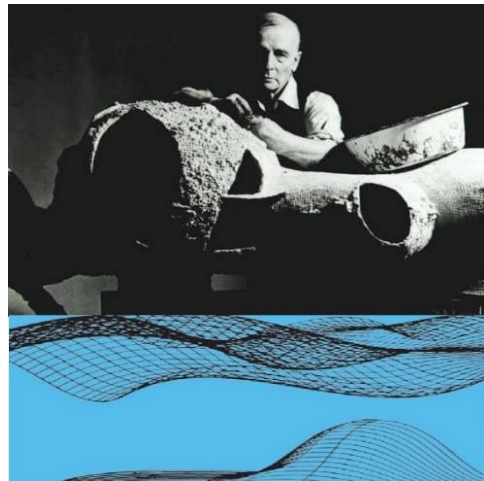


Figure 2 Frederick Kiesler with the model for his Endless House in New York, 1959 (Salvadori, 2005)

2.9 What tools are used in Parametric Design?

Grasshopper for Rhino, Dynamo for Revit, and Generative Components for Bentley platforms are examples of popular parametric authoring systems. These technologies are enhanced by scripting languages such as Python and performance simulations are integrated through analysis add-ins

like Ladybug/Honeybee and Insight 360. The parametric ecosystem is further expanded by other tools such as Autodesk FormIt, Rhino Compute, and custom plug-ins (Woodbury, 2010).

2.10 Benefits and limitations of using Parametric Design

Table 4 Benefits of Parametric Design (Oxman, 2021) (Burry, 2011) (Woodbury, 2010) (Terzidis, 2006)

Benefits	Description
Rapid Design exploration	Generate dozens of alternative schemes in minutes, fostering innovation under tight schedules.
Improved accuracy	Embed performance rules (daylight metrics, structural load paths) directly into the model, reducing manual errors.
Automated documentation	Schedules, sections and 4D/5D data update automatically with each parameter change, accelerating delivery.
Scalability and Consistency	Standardized templates adapt to multiple sites while preserving brand identity, cutting setup time for new locations.
Life cycle value	Rich, data-driven “families” support facility management and rapid retrofits, extending asset longevity.

Table 5 Limitations of Parametric Design (Davis, he parametric revolution in architecture: Scripting, customization, and control, 2007) (Woodbury, 2010) (Terzidis, 2006) (Eastman C. T., 2011) (Succar, 2009)

Limitations	Description
Steep Learning Curve	Mastering node-based logic and scripting languages demands significant training and practice (Davis, 2007).
Computational Overhead	Large parametric models can become slow and unwieldy, requiring high-performance hardware and careful file management (Woodbury, 2010).
Over-parametrization Risk	Excessive complexity leads to hard-to-debug models and maintainability challenges (Terzidis, 2006).
Interoperability challenges	Exporting to non-parametric formats (e.g. IFC) often strips out algorithmic intelligence, necessitating model reconstruction (Eastman, 1975).
Organizational resistance	Established workflows and contractual norms may impede adoption, as teams revert to familiar, traditional methods (Succar, 2009).

2.11 Collaborating BIM and Parametric Design in Retail architecture.

A significant advancement in UK retail construction has been made with the combination of parametric design and BIM, which combines algorithmic flexibility with organized data-rich collaboration. This collaboration promotes sustainability and operational efficiency while facilitating quicker design iterations, real-time performance feedback, and scalable, site-specific retail solutions (Gerber, 2022)

Table 6 Function and benefits of integrating BIM & Parametric Design (Gerber, 2022) (Gane, 2020)

Aspect	Function & Benefits
Computational parametric logic	Dynamic geometry driven by rule-based relationships (e.g., adjusting shelf spacing with aisle width).
BIM Metadata Integration	Combines geometry with data on materials, quantities, costs, maintenance, and schedules.
Real Time updates & coordination	Auto-updates across drawings, schedules, and clash detection upon parameter changes.
Retail roll-out efficiency	Templated parametric families save up to 30% setup time across multi-site projects, ensuring brand consistency.
Environmental Performance Analysis	Integration with tools like Ladybug & Insight allows optimization for daylight, solar gain, and thermal performance.
Improved stakeholder communication	Interactive layouts and analytics within BIM environments facilitate faster approvals and fewer late-stage design changes.
Facility Management Benefits	Parametric BIM models enhance asset tracking and reduce on-site waste through prefabrication logic.

2.12 Evolution of Retail architecture and construction trends in the UK

Table 7 Evolution of retail architecture & construction trends in the UK (Historic England, 2023)

Era	Retail Format	Drivers of change	Construction/Design Innovations
Early 19th–20th century	Local shops, family-run stores, outdoor markets	Local identity, walkable communities	Traditional craftsmanship, bespoke facades
Mid-20th century (Post-war)	Department stores, supermarkets	Consumerism, car culture, efficiency	Standardized layouts, steel/glass construction, escalators
Late 20th century	Enclosed malls (e.g., Bull Ring, Arndale Centre)	Retail as public space, suburbanization	HVAC systems, atria, modular construction
21st century	Multi-site retail chains, mixed-use developments	Digital retail, globalization, experience-driven design	BIM, prefabrication, environmental simulation tools

Rising consumption, urbanization, and digital innovation are some of the broader socioeconomic changes reflected in the evolution of UK retail architecture. Local identity and custom shopfronts influenced retail in the early 20th century, but post-war consumer demand led to a shift towards uniform supermarkets and shopping centers (Historic England, 2023). Retail was redefined as both public space and commercial infrastructure by the late 20th century, thanks to significant projects such as Manchester's Arndale Centre and Birmingham's Bull Ring (Royal Institute of British Architects, 2021).

Scalable and cozy retail spaces were made possible by developments in prefabrication, HVAC, steel-glass systems, and escalators. The complexity of retail design has increased in the twenty-first century, particularly as national chains and experiential formats have gained popularity. Digital methods such as Building Information Modelling (BIM) have become essential for managing this. Improved coordination, standardization, and lifecycle planning have been made possible by the private sector's broad embrace of the UK Government's 2016 BIM Level 2 mandate for public projects (UK BIM Alliance, 2022) (British Standards Institution, 2021)

3.0 Research Methodology

Introduction

This research uses a mixed-methods proposal to examine how parametric Building Information Modelling (BIM) can be used in UK retail architecture to enhance user experience and enhance project delivery. This method enables a balanced investigation of both technical results and human-centered insights, which is advantageous given the complexity of construction procedures and the increasing importance of end-user satisfaction in retail settings (Creswell J. W., 2018). Accurate coordination, cost-effectiveness, and design time improvements are measured by quantitative data gathered through organized questionnaires. Simultaneously, semi-structured

interviews yield qualitative data that advances our understanding of stakeholder viewpoints, organizational readiness for parametric BIM adoption, and practical challenges (Bryman, Social Research Methods, 2016). By capturing various perspectives, this methodological triangulation enhances the reliability and validity of the findings (Fellows, 2021). In digitally changing industries like construction, where technology and user behavior are rapidly influencing design and delivery techniques, the selected approach is particularly pertinent.

3.1 Research philosophy

The interpretive research philosophy employed in this study emphasizes the importance of recognizing the lived experiences and subjective meanings of those involved in implementing parametric Building Information Modelling (BIM) in the retail architecture sector. The interpretive position acknowledges that depending on their distinct responsibilities, expectations, and project objectives, stakeholders, including architects, project managers, BIM coordinators, and retail clients, may hold very different opinions about the benefits of BIM. This perspective enables a nuanced understanding of how parametric BIM tools are perceived and interpreted in actual construction contexts, as opposed to pursuing a single, objective reality. (Fellows, 2021)

This perspective will be strengthened by using a realism lens to examine the quantitative data. The realist component facilitates the examination of quantifiable results, such as project delivery schedules, cost savings, error reduction, and productivity measures. In contrast, the interpretive approach directs the investigation of stakeholder viewpoints and decision-making processes. This mixed philosophical approach enables the study to strike a balance between subjective observations and objective performance metrics, resulting in a more comprehensive assessment of parametric BIM's contribution to enhancing project delivery and user experience in UK retail architecture. This dual viewpoint supports the study's objective of comprehending the technical and human aspects of BIM implementation. (Creswell J. W., 2018)

3.2 Quantitative Approach of research

To assess the effect of parametric Building Information Modelling (BIM) on project execution and user experience in UK retail architecture, this study employs a quantitative research approach that focuses on gathering and statistical analysis of structured, numerical data. This approach enables systematic measurement of key characteristics, including usability, perceived efficiency gains associated with BIM integration, and spatial satisfaction, through surveys administered to both retail customers and construction experts. To support generalized conclusions, quantitative data enables the identification of trends and similarities across stakeholder groups and project types (Creswell J. W., 2018). Additionally, it enables the application of descriptive and inferential statistics, which are crucial for confirming performance and user response patterns (Bryman, Social Research Methods, 2016). Large datasets can highlight user preferences, project delivery efficiency, and the overall efficacy of digital tools, such as parametric BIM, making this method particularly helpful in the fields of construction and architectural research (Lu, 2023). The results of this investigation serve as the empirical basis for creating a framework that integrates BIM and is in line with customer-centric retail design concepts.

3.3 Structured Questionnaire Surveys

Table 8 Summary of Quantitative Survey Framework, Analytical Tools, and Visualization Methods (Researcher, 2025)

Component	Details
Respondent Groups	1. Retail Customers / End-users 2. Construction Professionals
Metrics Measured – Customers	a) Satisfaction with store layout and navigation b) Perceived comfort and aesthetics c) Ease of movement/accessibility d) Time spent in-store e) Ratings on spatial experience and usability
Metrics Measured – Professionals	a) Use and familiarity with parametric BIM tools b) Perceived impact on cost, time, collaboration, and flexibility c) Frequency and type of parametric functions used (e.g., automated layouts, clash detection)
Descriptive Statistical Analysis	a) Mean, median, mode (e.g., average customer satisfaction) b) Standard deviation (e.g., variation in BIM impact perception) c) Frequency distribution (e.g., BIM tool usage rate)
Cross-tabulation / Relationship Analysis	a) Age group vs satisfaction with spatial usability b) Role in construction (architect, PM, etc.) vs BIM efficiency perception c) Project type (e.g., Tesco vs M&S) vs cost/time performance ratings
Comparative Analysis	a) Parametric BIM vs traditional BIM projects b) Express vs flagship store formats c) Customers vs professionals
Visualization Tools	a) Bar charts b) Pie charts c) Histograms d) Scatter plots to illustrate satisfaction levels, adoption trends, and comparative insights

3.4 Qualitative research approach

This study investigates the practical experiences and opinions of construction professionals regarding the application of parametric BIM in UK retail architecture, employing a qualitative methodology. Architects, project managers, and BIM coordinators participated in semi-structured interviews that shed light on design flexibility, workflow difficulties, and user-centered implementation. Furthermore, case studies of Tesco and Marks & Spencer provide context for the use of BIM in actual retail projects. Thematic coding will be employed to analyze the data and identify key trends. By providing context and depth to the numerical data, this method enhances quantitative conclusions (Creswell J. W., 2018) (Abdirad, 2020).

3.5 Semi-structured Interviews

Table 9 Interview Respondents and Corresponding Research Objectives (Researcher,2025)

Interview With	Purpose of Interview
a) Architects	a) Explore personal experiences with parametric BIM.
b) BIM Coordinators/Managers	b) Understand perceived benefits, challenges, and workflows.
c) Project Managers	c) Gain insights into collaboration, adaptability, and design decision-making.
d) Retail Design Consultants	d) Collect real-world examples and narratives that inform framework development.
e) Store Managers (client-side)	(Optional) Provide user-side operational insights and feedback on design outcomes in retail environments.

3.6 Case studies (Tesco and M&S)

Table 10 Overview of Qualitative Research Methods and Thematic Analysis Approach Used in the Study (Researcher,2025)

Component	Description
Case Study Analysis	Qualitative tool to explore real-world application of parametric BIM in retail projects.
Focus Areas of Case Studies	a) Implementation of parametric BIM in specific retail projects. b) Design and delivery challenges and successes. c) Lessons learned and stakeholder feedback. d) Use of project documentation or published data.
Open-Ended Survey Responses	Qualitative data gathered through open-ended questions in customer and professional surveys.
Example Questions	a) "What did you like most about the store layout?" b) "What improvements would you recommend for future BIM workflows?"
Thematic Analysis Method	a) Coding transcripts and open-ended responses. b) Identifying recurring themes and subthemes (e.g., "flexibility", "coordination issues", "end-user neglect"). c) Linking themes to research objectives and theory.

3.7 Pilot feedback related to the questionnaire for the customers.

Four to five people with different ages and buying habits participated in a quick pilot study to evaluate the questionnaire's length, relevance, and clarity. The questions were simple, well-structured, and covered important facets of the retail experience like accessibility, emotional reaction, and creativity, according to participants' generally good feedback. To improve respondent convenience without compromising in depth, a few minor recommendations were made. All things considered, the pilot verified that the questionnaire is in line with the goals of the study and is going to provide insightful information. (Researcher,2025)

3.8 Pilot feedback related to the questionnaire for the professionals (like architects, engineers, designers, project managers, etc.)

Four to five industry professionals, including an architect, project manager, and BIM coordinator, participated in a pilot study to assess the professional questionnaire's relevance and intelligibility. The structured framework, balance of question types, and emphasis on real-world parametric BIM difficulties were highlighted in the mainly positive feedback. Clarifying background questions and combining related subjects, particularly those related to technological use and teamwork, were recommended. The questionnaire's readability, thoroughness, and ability to collect expert opinions in UK retail construction were all improved with the help of these observations. (Researcher,2025) Table 11 Research Planning Matrix for Data Collection on Parametric BIM in UK Retail Architecture

	What do I need to know?	Why do I need to know this?	What kind of data will answer the questions?	Where can I find the data?	Whom do I contact for access?	Timelines for acquisition
1	What is the perception of retail customers regarding spatial usability and store experience?	To evaluate how customer satisfaction and usability are influenced by parametric BIM design strategies.	Quantitative data from structured customer surveys (Likert scales, rating questions).	Distributed online through MS Forms to retail users.	Retail customers (volunteer participants from public/shoppers).	Survey live: June–July; Final responses by July 30.
2	What are construction professional's views on the efficiency and flexibility of parametric BIM?	To assess the effectiveness of parametric BIM in improving project delivery and collaboration.	Quantitative data from surveys and qualitative data from interviews (close and open-ended questions).	Professional networks, LinkedIn, or construction forums (MS Forms and MS Teams).	Construction professionals (architects, BIM coordinators, PMs).	Survey and interviews: June 15–July 31.
3	How is parametric BIM implemented in UK retail projects (Tesco & M&S)?	To understand real-world application of parametric BIM in retail architecture.	Qualitative case study data (documents, reports, interview notes from Tesco and M&S).	Published reports, architectural project files, and interviews with stakeholders from Tesco/M&S projects.	BIM leads or retail project managers from Tesco and M&S.	Case study data gathering: June–August.
4	What are the familiar challenges and benefits experienced during parametric BIM adoption?	To identify barriers and enablers to implement parametric BIM in retail design workflows.	Interview transcripts and open-ended survey responses thematically coded.	Collected during expert interviews with architects, BIM managers, and consultants.	Industry professionals are familiar with BIM workflows in the retail sector.	Interviews and thematic coding: July–August.

(Researcher,2025)

4.0 Data collection and analysis

The data is gathered using a combination of methods, including semi-structured interviews, structured questionnaires, and case studies, to assess how parametric information modelling (BIM) can improve user experience and project delivery in UK retail architecture. The survey is divided into three main parts: comparative case study evaluations of Tesco and Marks & Spencer (M&S); qualitative insights from interviews and open-ended survey responses; and quantitative results from professional and customer surveys. The discussion examines trends, stakeholder viewpoints, and valuable results using this triangulated approach, connecting these findings to the study's goals and the corpus of previous literature. (Researcher,2025)

4.1 Customer Survey Analysis

Knowing what matters most to experts and customers is essential in the dynamic field of retail design, where experience frequently outweighs goods. This survey-based analysis explores the actual voices influencing retail's future, from the model's creator to the customer wandering the aisles. The ability to combine design intelligence and human experience is increasing with the popularity of parametric BIM. What happens when algorithms pay attention to feedback, and data meets emotion? This intersection is explored in the study that follows, which provides an overview of the challenges, new developments, and revolutionary possibilities in developing retail environments that cater to the needs of their customers (Researcher,2025).

4.2 The People Behind the Aisles: Who's Shopping and Who's Designing?

The bulk of shop visitors and retail design influences are young, digitally literate people (ages 18–34), according to survey data from both experts and customers. Professionally, the answer group was dominated by architects (45%) and early-to-mid career practitioners (80% with less than five years' experience), indicating a willingness to try new things while also emphasizing the urgent need for skill development in parametric tools like Dynamo and Grasshopper. (Creswell J. W., 2018)

4.3 Walking the Aisle: What Makes Retail Work (or not)?

Space, simplicity, and sensory comfort are the cornerstones of successful retail design for consumers. The main factors that respondents cited as motivating them to spend more time in a store were open layouts (68%), obvious signage (52%), and cozy surroundings (58%). Nonetheless, 45% of respondents stated that they deliberately steer clear of stores with bad design, citing narrow aisles, perplexing product placement, and uneven branch layouts. These problems demonstrate how geographical inefficiencies affect user loyalty and happiness. (Davis, The advantages of parametric computer-aided design for architecture and building design, 2007)

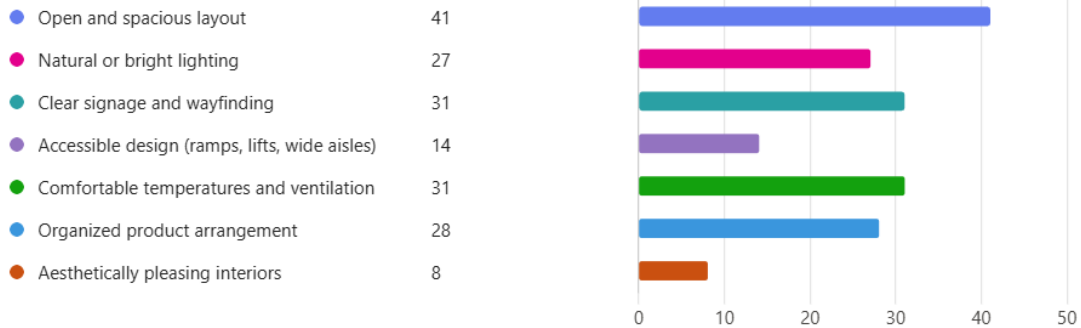


Figure 4 Showing what elements do people think contribute most to the positive shopping experience. (MS Forms)

4.4 The Feedback Loop: A Missed Opportunity

Only 25% of professionals stated that user feedback is always considered during the design process, even though 63% of customers are prepared to offer their thoughts in order to improve the retail experience. This discrepancy highlights a significant chance to incorporate structured feedback loops straight into the design process using digital kiosks, QR surveys, or post-occupancy assessments. By incorporating this data into parametric BIM models, more responsive and customized places that are in line with actual user needs may be created.

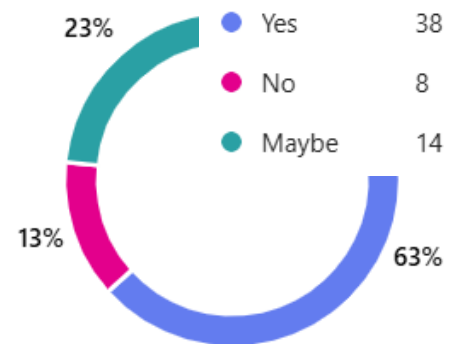


Figure 3 Showing if people are willing to give their feedback or not. (MS Forms)

4.5 Technology on the Floor: Awareness and Adoption Gaps

Even though 58% of professionals have utilized parametric BIM software, utilization is still uneven. Despite its obvious promise to promote consistency and adaptability across locations, just 15% have used it for multi-site rollouts and only 13% consistently utilize it in retail initiatives. According to 53% of customers, they were not aware of how BIM influenced store layouts. This knowledge gap highlights the necessity of public-facing engagement tactics, like social media content, VR demonstrations, and in-store visuals, to increase awareness of how digital tools improve retail experiences.

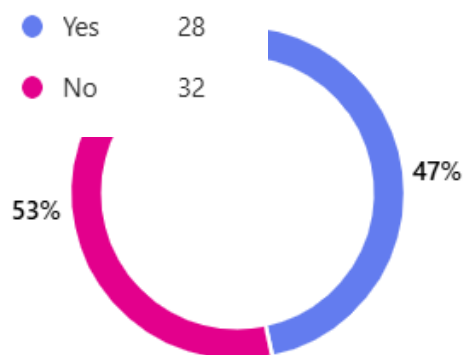


Figure 5 Showing if people are aware of 3D design tools being used in planning of store layouts. (MS Forms)

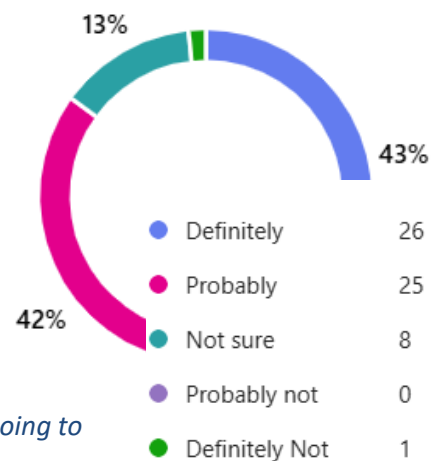
4.6 Friction Points in Adoption: The Hidden Costs of Innovation

When professionals were asked about barriers, limited expertise (31%), steep learning curves, and high setup costs topped the list. Clients were also cited as reluctant to invest in new technologies, with only a minority demonstrating high awareness of parametric BIM's potential. Suggestions for improvement included standardizing component libraries, integrating feedback mechanisms into design software, and enhancing interoperability between platforms. (Oxman, 2021)

4.7 Customers Want Change- And They're Clear About It

Customers' desire for more user-friendly, accessible, and cozy stores was evident in both multiple-choice and open-text comments. Wider aisles, more readable signage, modular shelves, biophilic zones, and improved temperature control were among the design recommendations. Crucially, 93% of consumers concurred that their level of satisfaction would rise dramatically if layouts were able to adapt to their comments. This provides compelling evidence for combining human-centered data inputs with parametric BIM, transforming passive users into co-creators.

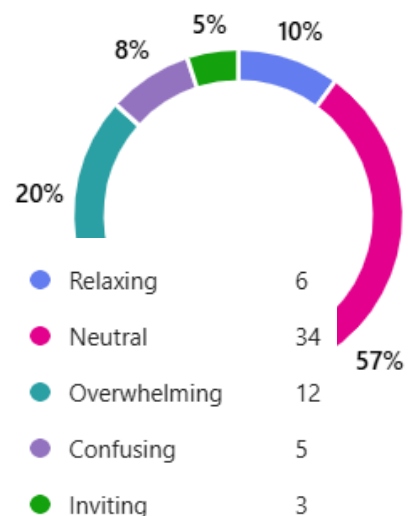
Figure 6 Showing if people think that their feedback is going to improve their retail experience. (MS Forms)



4.8 Emotional Design: Not Just What You See, But What You Feel

20% of consumers reported feeling overwhelmed, while 57% reported feeling indifferent when questioned about their emotional experiences in-store. Just 5% of respondents thought that store spaces were "inviting." Despite their influence on mood, lighting, color, music, and layout are frequently disregarded in traditional BIM workflows. With the help of sensory and emotional data, parametric BIM could model and improve settings that encourage joy and relaxation rather than bewilderment and exhaustion.

Figure 7 Showing what is the emotional experience in most retail environments. (MS Forms)



4.9 Flexibility Is the Future: Adaptable Design for Adaptable People

Only 18% of professionals said their models were "very adaptable" across sites with minor variations. Yet scalability is key to cost-efficient rollouts in chains. Customers also called for flexible features like modular furniture and digital wayfinding. With parametric BIM, design teams can create rule-based templates that respond to variables like site size, foot traffic, or accessibility needs, enabling stores to evolve alongside their customers.

Figure 8 Showing feedback of people about what aspects of retail environment should be improved. (MS Forms)

1	anonymous	Flexible reach and proper lay out
2	anonymous	A non commercial sitting area should be provided.
3	anonymous	Make a map atleast where the products that I want are located.
4	anonymous	Shops
5	anonymous	Bigger aisles, not too many products in a store as they look overpowering
6	anonymous	Open space and well contained materials
7	anonymous	Space, directions, product placement
8	anonymous	Ease to navigate to product

4.10 Collaboration and Communication: BIM as the Bridge

85% of professionals said parametric BIM improves team collaboration, especially when paired with cloud platforms and centralized data environments. However, real-time updates, client communication, and scenario testing need to be streamlined. The future lies in smarter dashboards, VR simulations, and cross-functional workflows that keep all voices, architects, clients, users heard and aligned.

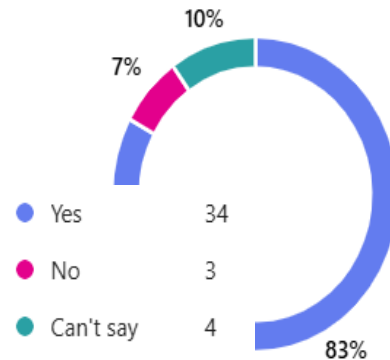


Figure 9 Showing VR Walkthroughs before constructing. (U-Green, 2025)

4.11 The Verdict: Design That Listens

Across the board, whether from professionals or customers, one message was clear: retail spaces work best when they are adaptive, inclusive, and emotionally engaging. With 83% of both groups agreeing that integrating user feedback into parametric BIM will improve design outcomes, the case for a responsive, data-driven approach is undeniable. Parametric BIM isn't just about code and geometry; it is about creating spaces that feel as good as they function. (Researcher,2025)

Figure 10 Showing responses of people about will the feedback integrated with Parametric BIM is going to improve their experience. (MS Forms)



4.12 Customer's responses and Interpretations:

Table 12 Customer's Responses and Interpretations

Q#	Theme	Key Finding	BIM-Driven Design Implication
1	Demographics	Majority aged 18–34 (93.1%)	Designs should target tech-savvy, trend-conscious users
2	Visit Frequency	Most visit 2–3 times/week (32%) or weekly/monthly (23% each)	Design for regular efficiency, ease, and comfort
3	Store Type Preference	Supermarkets & Clothing stores most visited (44 each)	Prioritize designs for these high-traffic environments
4	Satisfaction Rating	43% rated it 'Good'; 10% 'Excellent'	Target minor improvements in layout and comfort
5	Navigation Ease	The majority find it easy to navigate	Minor adjustments through feedback & flow simulation
6	Layout Discomfort	32% have experienced discomfort	Feedback can highlight problem areas for spatial improvements
7	Positive Experience Elements	Top: Open layout, Signage, Temperature, Product Arrangement	Parametric BIM can simulate comfort, flow, and visibility improvements
8	Challenges Faced	Top: Narrow walkways, Confusing layouts	BIM can dynamically <u>test</u> and improve layouts
9	Design Improvement Suggestions	Wider aisles, Better signage, Product zones, Accessibility	BIM enables flexible, user-driven spatial simulations

10	Willingness to Share Feedback	63% say Yes, 23% Maybe	Strong case for integrating ongoing customer feedback in BIM
11	Awareness of BIM	47% aware, 53% unaware	Educate via signage, apps, and campaigns
12	Feedback-Driven Design	85% support it	Persuasive case for user-centered design with BIM
13	Emotional Experience	57% feel Neutral, 20% Overwhelmed	BIM can simulate ambiance and emotional impact
14	Avoid Stores Due to Design	45% do avoid	Improve layout, accessibility, flow with BIM feedback
15	Ambience Importance	73% rated it 4–5	Simulate light, sound, materials in BIM
16	Average Store Time	15–30 mins	Optimize layout for quick yet satisfying engagement
17	Features That Prolong Visits	Cleanliness, Navigation, Clear Sections, Lighting	Model all for extended dwell time
18	Ask Staff for Help	75% ask for help	Improve signage/navigation using customer feedback
19	Modern Design Reflection	71% agree	Ensure stores continue evolving with trends via BIM
20	Support for Dynamic Layouts	93% believe it will improve experience	Implement real-time feedback + parametric layouts
21	Tech/Design Preferences	Desire for digital maps, modular design, accessibility, AR	BIM enables modeling of smart, adaptive, inclusive retail features

4.13 Professional Survey Analysis

The voices behind the blueprints, architects, designers, BIM coordinators, and project managers, provide crucial insight into the shifting trends of technology and user-centric design in the dynamic field of retail construction. A cross-section of industry professionals negotiating the transition from traditional processes to parametric, data-driven tactics are represented in this poll. Parametric BIM sits at the nexus of creativity and functionality as retail spaces require greater flexibility, effectiveness, and emotional resonance. The experts' thoughts, actions, and visions are explored in detail in this part, demonstrating how near we are to having genuinely intelligent, responsive retail spaces. (Researcher,2025)

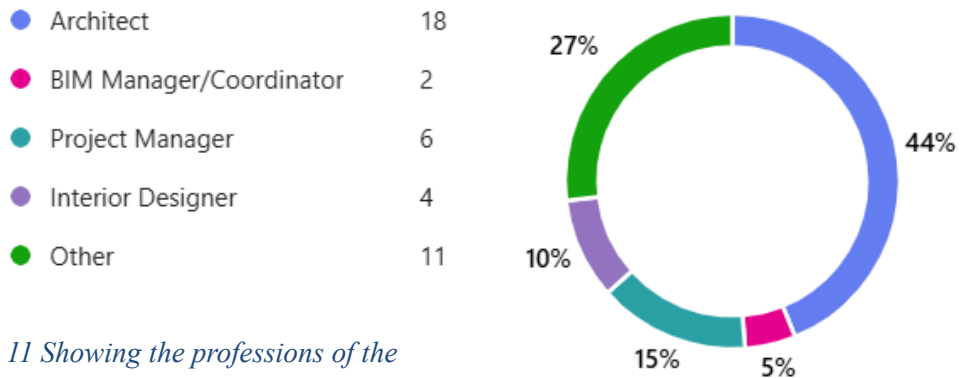


Figure 11 Showing the professions of the respondents. (MS Forms)

4.14 Who's Shaping the Future?

Architects accounted for 45% of the professional landscape in this study, with interior designers, project managers, and BIM coordinators following closely behind. Practical insights into the use of parametric BIM tools in real-time project scenarios are provided by the prevalence of experts with a design concentration. Interestingly, 80% of respondents had less than five years of experience, suggesting that they are a youthful, innovative bunch that would be more open to adopting new digital workflows. (Researcher,2025)

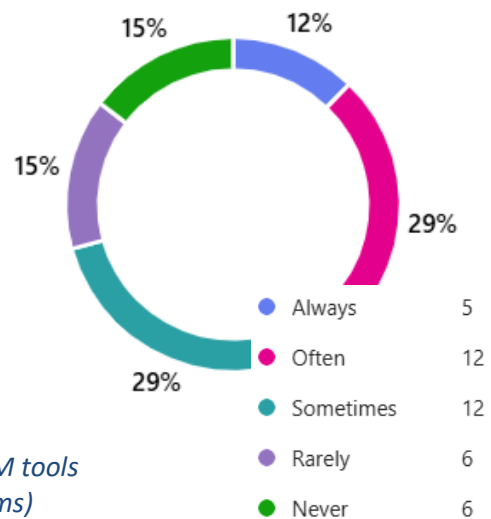


Figure 12 Showing how often are parametric BIM tools used in retail construction projects. (MS Forms)

4.15 Not Just Tools, Transformers of Design

Approximately 58% of professionals have experience using parametric BIM technologies such as Grasshopper or Dynamo. Nonetheless, there is a glaring disparity as 38% have not yet investigated them. Efficiency and accuracy are prioritized by those who use the tools primarily for layout automation (34%) and clash detection (32%). However, advanced capabilities like quantity take-off and standardization are still underutilized, indicating a need for more extensive awareness and skill development. (Researcher,2025)

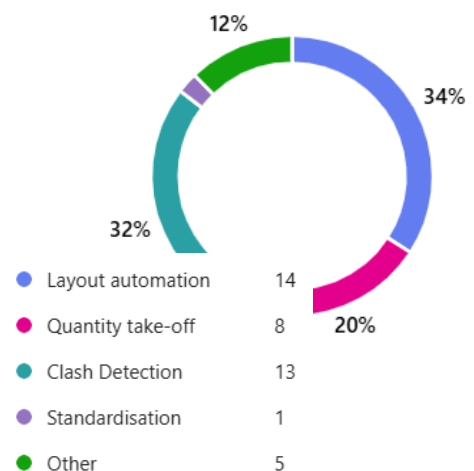
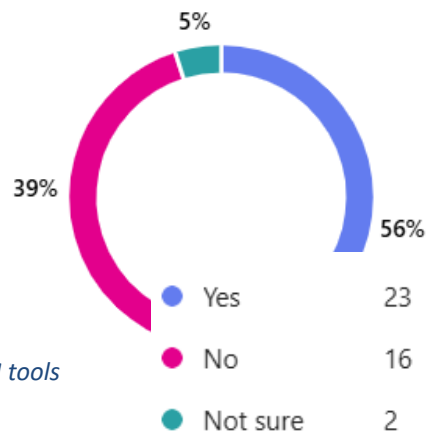


Figure 13 Showing the primary purposes for which the BIM tools are used in projects.

4.16 Adoption: Growing but Uneven

Almost three-quarters (56%) said they had used parametric BIM in retail projects at least once. Though 39% still reported little to no usage, this is encouraging. High setup effort, steep learning curves, and inadequate training are frequently mentioned obstacles. To make adoption easier and more appealing for organizations, experts stressed the necessity for pre-built templates, streamlined onboarding, and client education. (BIMplus, 2023)

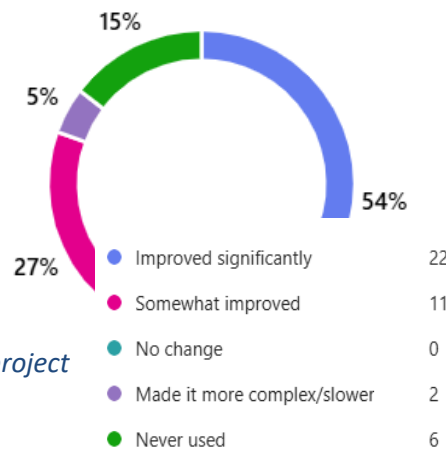
Figure 14 Showing that if professionals have used BIM tools in their construction projects or not. (MS Forms)



4.17 Speed Meets Smart: Project Delivery Benefits

According to a noteworthy 83% of professionals, parametric BIM speeds up project delivery with capabilities like real-time change responses and automated revisions. Just 5% said it had an adverse effect. However, 63% of respondents said they hardly ever or never use parametric tools for quick on-site changes. This suggests a disconnect between aptitude and real-world application that may be closed with increased exposure and training. (Autodesk, 2022)

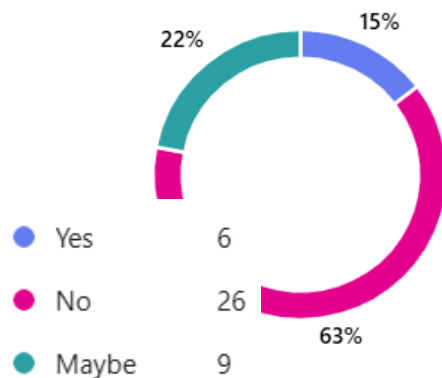
Figure 15 Showing what professional thinks about the project delivery speed after using BIM tools. (MS Forms)



4.18 The Untapped Power of Rollouts

Despite parametric BIM's well-known advantages, such as standardization, quick replication, and localization, just 15% of experts have utilized it for rollouts across numerous shop locations. This suggests that a scalable retail expansion opportunity was lost. For developers and retail chains alike, a stronger focus on flexible blueprints, reusable parts, and site-responsive logic may unlock its potential. (Researcher,2025)

Figure 16 Showing if professionals have used parametric BIM for multiple store rollout projects. (MS Forms)



4.19 Listening to the Users: The Feedback Loop

Almost half of respondents (48%) believe customer feedback can be effectively integrated into parametric BIM models. Another 25% have not tried it yet, and 25% remain unsure. Encouragingly, 53% strongly believe a flexible parametric framework that incorporates feedback would benefit their projects. This underscores the growing recognition that retail spaces should be dynamic, adaptive, and deeply user centered. (Alsofiani, 2024)

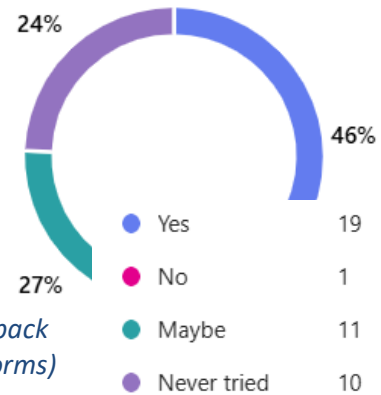


Figure 17 Showing what professionals think about if the feedback integrated with Parametric BIM will be effective or not. (MS forms)

4.20 Design Factors that Matter Most

Customers were most satisfied with layout (28%), aesthetics (24%), and accessibility (23%). Experts understand that a great shop design must strike a balance between emotional comfort and functional clarity. The shopping experience can be made more inclusive and intuitive by using parametric BIM to simulate and modify spatial arrangements depending on actual user behavior and needs.

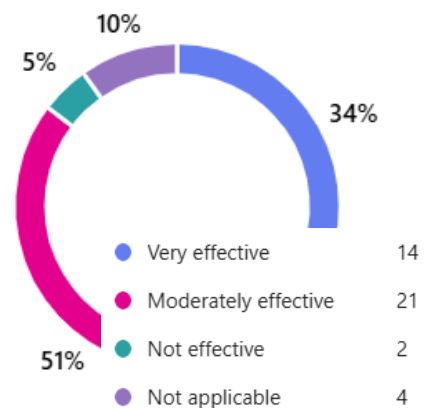


Figure 18 What design factors matter the most about customer satisfaction. (MS Forms)

4.21 Collaboration Without Boundaries

Parametric BIM collaboration was judged as either moderately or extremely effective by a resounding 85% of respondents. Cross-disciplinary cooperation is improved by tools like shared visual scripting, automated model updates, and cloud-based BIM 360. However, experts urge improved interoperability and support systems to optimize these advantages, particularly for expansive, dispersed retail initiatives. (Researcher,2025)

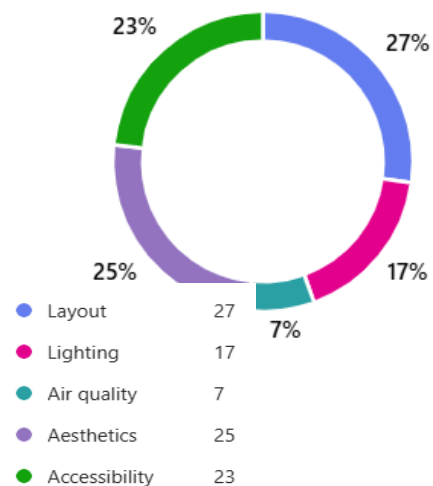


Figure 19 Showing how effective collaboration is using parametric BIM across teams

4.22 Clients: Curious but Cautious

Few clients demonstrate a significant need for parametric BIM solutions, and client-side understanding is still moderate to poor. Respondents emphasized the value of using interactive design walkthroughs, ROI-backed case studies, and live VR demos to engage clients. By doing this, the knowledge gap can be closed, and higher adoption can be encouraged from the top down. (British Standards Institution, 2021)

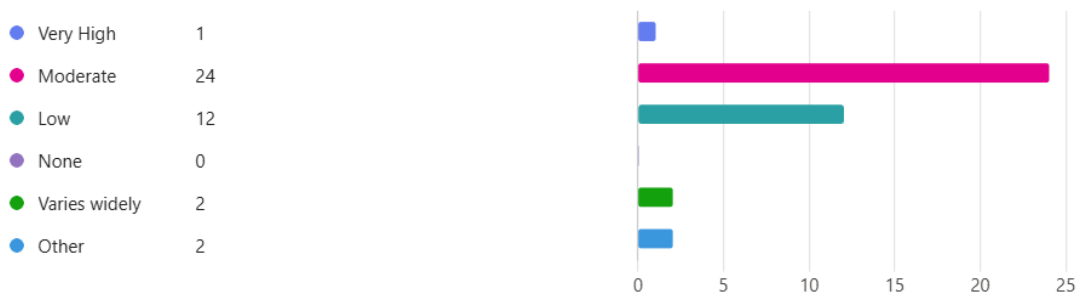
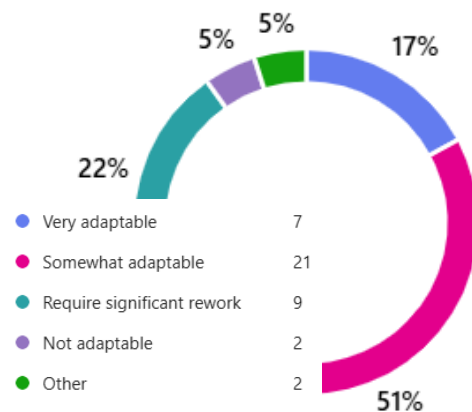


Figure 20 Showing the client's understanding and demand for parametric BIM in projects. (MS Forms)

4.23 Scaling Smart: Adaptability Challenges

Half of the respondents said their models were only somewhat adaptable across multiple sites, while just 18% found them highly reusable. The need for significant rework undermines BIM's promise of scalability. By embedding local codes, site variables, and smart component logic, professionals can make models more modular, agile, and rollout ready.

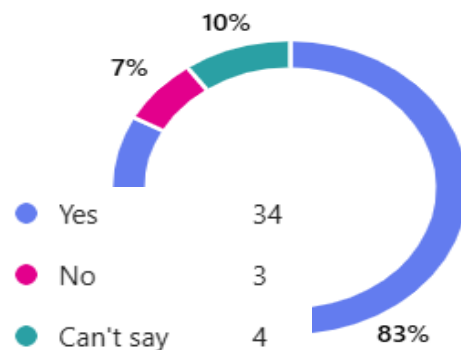
Figure 21 Showing if the current 3D models are adaptable for multiple store layouts. (MS Forms)



4.24 The Road Ahead: More Than Just Modelling

Overwhelming support (83%) exists for integrating user feedback into parametric BIM workflows. Suggested improvements focus on training, collaboration, and technology alignment. Professionals called for user-friendly interfaces, better cross-platform compatibility, and stronger post-occupancy support to enhance overall project delivery.

Figure 22 Showing what professionals think if parametric BIM should be integrated with user's feedback. (MS Forms)



4.25 Professional's Survey and interpretations

Table 13 Professional's Survey and Interpretations

Q#	Theme	Key Finding	Parametric BIM Design Implication
1	Professional Role	45% Architects; 25% Other professionals	Incorporate cross-disciplinary insights, especially from architects
2	Years of Experience	80% have <5 years experience	Focus on tools and workflows suited for early-career professionals
3	Experience with Parametric BIM	58% used it; 38% haven't	Promote training, case studies, and hands-on tools for wider adoption
4	Frequency of Use	30% often, 30% sometimes, 13% never	Adoption varies; standardization and training can help
5	Common Platforms	Revit dominates; Dynamo/Grasshopper underused	Encourage parametric tool adoption via education and templates
6	Primary Purposes	Layout automation (35%), Clash detection (33%)	Focus on layout logic and integration with clash tools
7	Impact on Project Delivery	83% report improved speed	Highlight ROI via automation and real-time coordination
8	Multi-store Rollouts	15% used parametric BIM for this	Showcase scalability with reusable templates
9	Challenges in Use	Top: Limited expertise, learning curve	Training, templates, and client education needed
10	Use of User Feedback	25% always, 33% sometimes	Encourage structured feedback use during design
11	Feedback Integration into BIM	48% say yes; 25% unsure	Simplify feedback-to-BIM workflows via scripts, dashboards
12	Key Design Factors	Layout (28%), Aesthetics (24%), Accessibility (23%)	BIM should optimize layout and sensory/accessibility parameters

13	Need for Flexible Framework	53% definitely support	Build reusable, feedback-adaptive models
14	Use for Last-minute Changes	Only 15% frequently use it	Promote onsite flexibility training and tools
15	Collaboration Effectiveness	85% say it's effective/moderately effective	Push for centralized data and cloud collaboration tools
16	Future Role of Parametric BIM	93% view it as supportive or critical	Invest in long-term integration and research
17	Client Understanding	Majority say awareness is moderate/low	Focus on client demos, VR, success stories
18	Model Adaptability	50% say 'somewhat adaptable'	Develop adaptable templates using parameters like site code/size
19	Feedback + Parametric BIM	83% support integration	Model spatial improvements directly from feedback
20	Suggestions for Integration	Training, standardization, collaboration, tech upgrades	Holistic process revamp for better implementation

4.25 Qualitative Data

1 Semi-structured Interviews:

I conducted semi-structured interviews with construction professionals, including architects, BIM coordinators, and project managers, as well as one Primark retail employee to explore the practical use of parametric BIM in UK retail settings. Understanding technical and practical viewpoints on its use, difficulties, and enhancements, especially through user feedback, was the goal. The retail worker explained how design affects day-to-day operations and customer experience, while the experts talked about the advantages and drawbacks of parametric tools. Overall, the interviews demonstrated a strong need for more adaptable, feedback-driven processes and reaffirmed parametric BIM's capacity to unite user-centric retail design with digital innovation. (Burry, 2011)

2. Retail Employee Interview

This interview was conducted with a Primark retail assistant who has been working in the store for five years. The participants emphasized the significant impact of store layout, lighting, signage, and accessibility on customer behavior and satisfaction. The assistant noted that while crowded or dimly lit spaces irritate patrons, a clear, roomy layout promotes longer visits and easier navigation. Improved airflow and signs are common requests in feedback. The participant further emphasized the immediate impact that seasonal display modifications

have on client flow. Importantly, they expressed strong support for integrating customer feedback and digital tools like BIM and VR into store planning to enhance design efficiency and the entire retail experience for both patrons and employees. (Researcher,2025)

3. BIM Construction Professional Interviews

Interview 1

This interview presents insights from Moustafa, a Digital Construction Coordinator with 13 years of experience in the construction industry. He specializes in using BIM and parametric tools like Revit and Dynamo to enhance delivery in retail projects. Moustafa emphasizes how parametric BIM facilitates rapid design iterations, enhances coordination, and guarantees uniformity across several retail locations. He does, however, highlight certain difficulties, such as a lack of expertise, script restrictions, and interoperability problems.

He explains that feedback from the customers or users is generally taken post occupancy, limiting its influence on decisions that could have been taken earlier, related to better designs. His team aims to address this by integrating user input earlier through tools like VR walkthroughs and digital feedback systems. He emphasizes that emotional aspects, comfort, layout clarity, and ambience, are just as vital as function in retail spaces. Moustafa advocates for stronger multidisciplinary collaboration and believes that parametric BIM can bridge efficiency and empathy, making design more responsive and user centric.

Interview 2

A Senior Digital Engineer with 17 years of building industry experience, Monteiro Costa Baltasar, shares his viewpoint in this interview. In his discussion of parametric BIM's expanding influence on retail project delivery, he emphasizes how it makes flexible, data-driven design solutions possible. While his team has worked on projects where spatial design was influenced by user experience, he notes that feedback was typically collected after occupancy, often through a trial-and-error approach. Baltasar advocates for integrating user insights earlier in the design process using tools like BIM and Enscape, to create more responsive and human-centered retail environments.

He highlights the promise of parametric workflows to improve multidisciplinary collaboration while also sharing concerns including team skill gaps and striking a balance between speed and site-specific constraints. In the end, he thinks that integrating digital intelligence with actual consumer input might result in more effective, sympathetic, and flexible design solutions for contemporary retail architecture.

Interview 3

This interview features insights from Dr. Shalaka Hire, an Assistant Professor and PhD holder in BIM-enabled automated site safety, with expertise in Revit, Solibri Office, and Navisworks. She discusses how the shift from traditional to parametric BIM has transformed retail project delivery by enabling faster, rule-based design adjustments, greater standardization, and improved cost and coordination outcomes. While acknowledging

technical challenges, particularly interoperability and file size issues, she explains how her team mitigates these using IFC formats and export protocols. Although she hasn't directly worked with user-driven spatial design, she strongly advocates for involving customers through virtual walkthroughs before construction to gather early feedback and minimize costly rework.

Dr. Hire identifies quantitative user data as key to informing effective retail layouts and believes parametric workflows and cloud-based platforms enhance multidisciplinary collaboration. She concludes that integrating customer feedback into parametric BIM can significantly improve both user satisfaction and the overall design quality in retail environments.

4. Case studies

This study compares two well-known businesses, Tesco and Marks & Spencer (M&S), to examine the revolutionary potential of parametric Building Information Modelling (BIM) in UK retail design. Tesco's sophisticated parametric processes and M&S's commitment to conventional, Level 2-compliant BIM systems serve as examples of two different BIM methodologies. This section is based on the detailed study which is mentioned in Appendix C below.

Tesco: Scaling Innovation through Parametric BIM



Figure 23 Tesco Roll out store (Tesco, 2024)

Tesco's retail expansion demonstrates a progressive approach to digital construction, especially the Tesco Express Roll-Out Program (2018–2022). Tesco implemented parametric BIM workflows to overcome the difficulty of quickly and consistently adapting designs to a wide range of sites (BIMplus, 2023). Tesco developed a strong library of adaptable, parameter-driven components, like shelving, lighting, and refrigeration units, using Autodesk Revit and Dynamo. These components could be quickly deployed and tailored to the

specific site conditions. (Autodesk, 2022). Script-based automation-powered templates made it possible for store layouts to be generated automatically, drastically cutting down on design time (by as much as 60% each store) and improving accuracy. COBie-compliant data integration made asset management and FM handover smooth (BuildingSMART UK & Ireland, 2022). The process was further expedited by early-stage simulations for energy and accessibility compliance and real-time clash identification, which enhanced project delivery and regulatory alignment (Cousins, 2023). As a result, Tesco decreased waste and design errors overall while also expediting the opening of more than 200 locations.

Marks & Spencer: Rigor in Traditional BIM



Figure 24 M&S Flagship store (Lawrence I. , 2024)

The Marble Arch Redevelopment Project (2020–2023) by M&S, on the other hand, adopted a more methodical, cautious BIM approach. M&S used conventional tools like Revit, Navisworks, and BIM 360 without utilizing parametric or algorithmic design capabilities, despite being completely compliant with UK BIM Level 2.



Figure 25 Potential Designs for M&S Oxford Street (Lawrence I. , 2024)

This method limited flexibility and iterative testing, but it guaranteed data integrity and strong coordination (Autodesk Inc., 2022). Although this method brought drawbacks, it guaranteed data consistency and regulatory compliance. Modifications to the vertical circulation, decreasing feedback cycles, and increasing coordination effort all needed manual remodeling (NBS, 2023). Although effective, clash detection was done after the fact and lacked the real-time flexibility that parametric scripting provided (Cousins, 2024). To create silos between design and performance data, simulations for sustainability, daylighting, and access were carried out independently (BuildingSMART UK & Ireland, 2022).

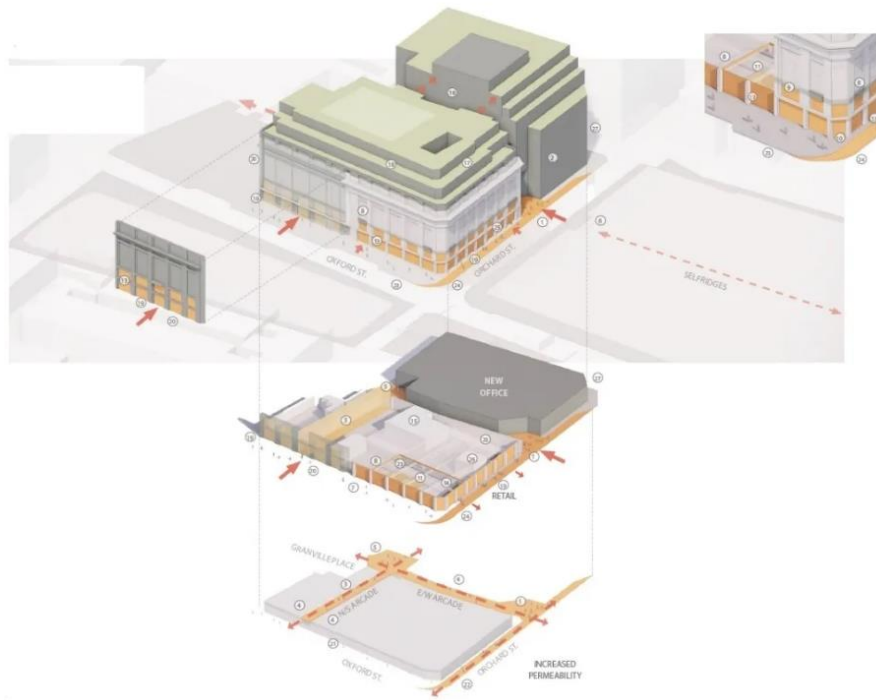


Figure 26 The old flagship store for M&S Oxford Street (Lawrence I. , 2024)

4.26 Key differences and Insights

Comparative results highlight parametric BIM's speed, agility, and integration. Tesco's component-driven processes and dynamic scripting made it possible to quickly implement consistent yet site-specific layouts, which were perfect for high-volume retail projects. During stakeholder meetings, real-time visualization improved client involvement and decision-making as well (BIMplus, 2023).

In contrast, M&S's conventional BIM approach, which placed a higher priority on coordination but lacked flexibility, was better suited for one-off flagship projects. Iterative testing was restricted by static walkthroughs, and implementing feedback required days rather than hours (Autodesk Inc., 2022). Although both strategies produced compliant models, Tesco's approach was the only one to show full lifecycle integration and real-time design evolution.

4.27Summary: Toward Digitally Mature Retail Delivery

According to this comparison, parametric BIM fits in nicely with the scalable, quick-paced nature of contemporary retail rollouts. It is a major improvement over traditional processes since it can support real-time adaptation, simulate early, and include automation. But making the switch to parametric BIM necessitates spending money on collaborative culture, scripting tools, and digital skills (BIMplus, 2023) (BuildingSMART UK & Ireland, 2022). According to the facts, retail clients who want flexibility,

sustainability, and quicker delivery should use parametric techniques, as Tesco has shown. Even if M&S's strategy remains useful, it could be strengthened by incorporating algorithmic techniques to stay competitive in the rapidly changing retail market.

5.0 Conclusion and Recommendations

5.1 Conclusion

This study explored the transformative role of Parametric Building Information Modelling (BIM) in enhancing project delivery and user experience within UK retail architecture. The study has shown that parametric BIM has great potential to transform design workflows, increase productivity, and facilitate a more user-focused approach to retail environments through a thorough literature review, qualitative interviews with industry professionals, and customer feedback analysis.

The findings reveal that parametric BIM improves collaboration, reduces rework, and supports data-rich decision-making, thus streamlining project delivery from design to post-occupancy stages. Moreover, by facilitating dynamic simulation and analysis of spatial configurations, lighting, and customer flow, parametric BIM empowers architects and project managers to design more responsive, engaging, and efficient retail spaces.

The study did, however, also draw attention to problems like software incompatibility, a dearth of standardized training, and reluctance to adapt within conventional construction companies. To fully utilize parametric BIM, these obstacles must be systematically removed, especially for small to mid-sized retail projects where adoption of digital technology may be constrained by resource limitations.

5.2 Recommendations:

1. For industry practitioners

- Integrate real-time customer feedback loops into BIM workflows using digital surveys and sensors.
- Develop parametric rule sets for frequently encountered retail challenges (e.g., poor navigation, crowding).
- Upskill teams in visual programming tools like Dynamo or Grasshopper.
- Invest in cross-functional collaboration, involving UX designers in early design phases.

2. For architects and BIM consultants:

- Use simulation tools (e.g., Navisworks, Insight) to test parametric design responses to feedback.
- Develop adaptive BIM templates for scalable deployment across multiple retail sites.
- Employ VR walkthroughs and customer co-design workshops to validate and refine designs.

3. For educational institutions

- Introduce modules on feedback-driven parametric BIM workflows in architecture, construction, and retail design programs.
- Create opportunities for industry-academic collaboration through live retail BIM projects.
- Encourage interdisciplinary studies integrating UX, retail behavior, and parametric modelling.

4. For policy makers and regulators

- Promote BIM maturity assessments in retail procurement strategies.
- Fund innovation grants for SMEs to adopt parametric tools and digital twin strategies.
- Encourage the development of national guidelines that incorporate user-centric parametric BIM practices.

5. Practical implications

The research's conclusions provide practitioners in the construction and retail sectors with quick, practical solutions. Design teams and project managers can:

- Utilize parametric components to cut down on design and rework time.
- Build data-driven environments that improve customer comfort, safety, and navigation.
- While modifying store design to accommodate different site conditions, maintain brand consistency.

In addition to increasing construction speed and post-occupancy satisfaction, retailers can use this approach to scale feedback-driven design across locations.

6. Theoretical implications

This research advances theoretical understanding in the following areas:

- Bridges parametric design theory with user experience frameworks,
- Provides a new model of feedback-to-BIM integration that can provide as a starting point for additional research,
- Enriches BIM literature by framing it as a tool not only for efficiency but also for empathetic and human-centric design in commercial architecture.

7. Suggestions/concerns of customers and how they can be incorporated.

Customers suggested several areas for improvement in the UK retail environment based on their shopping experiences. These include concerns around layout clarity, digital integration, lighting, crowd flow, and sustainability. Their feedback is summarized below, along with proposed parametric BIM strategies to address each issue.

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