

A Comparative Review of BIM-Based Software in Landscape Design: Vectorworks vs Autodesk Revit

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Abstract: While Building Information Modelling (BIM) is widely adopted in architecture and engineering, its implementation in landscape architecture remains limited. This paper presents a comparative study of Autodesk Revit and Vectorworks, evaluating their suitability for Landscape Information Modelling (LIM). The comparison focuses on modelling techniques, data integration, and usability. Given the complexity of BIM software selection, a comprehensive evaluation framework was developed through literature review. To validate the findings from the literature review, expert interviews were conducted with BIM professionals in the landscape industry, and the collected data were analysed using the multi-criteria decision-making methods AHP (Analytic Hierarchy Process) and TOPSIS (Technique for Order Preference by Similarity to Ideal Solution). The study aims to provide insights to enhance landscape modelling workflows and promote broader adoption of LIM within the profession.

Keywords: Landscape Information Modelling (LIM), Multi-Criteria Decision Making (MCDM), Analytical Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

1 Introduction

With the rapid expansion of urban spaces and the increasing demand for large-scale housing developments, the importance of landscape architecture / urban design within the construction industry cannot be overlooked (CHESHMEHZANGI 2018). However, the landscape sector within the construction community remains relatively slow in adopting Building Information Modelling (BIM) practices, especially compared to other disciplines within the Architecture, Engineering, and Construction (AEC) industry (NIKOLOGIANNI et al. 2022)

This hesitancy is often attributed to the limitations of current software tools, which are primarily designed to support building development rather than landscape-specific needs (NIKOLOGIANNI et al. 2022). As a result, tools for effective landscape modelling remain scarce, leaving landscape architects under equipped to fully embrace BIM workflows. The concept of Landscape Information Modelling (LIM) has emerged to address this gap, offering solutions tailored to the unique requirements of landscape architecture (AHMAD & ALIYU 2012). However, there is a significant lack of research and literature exploring LIM tools and their effectiveness in meeting landscape-specific needs (NIKOLOGIANNI et al. 2022). While many available software platforms prioritize architectural modelling, the specialized needs of landscape modelling, such as terrain, vegetation, and outdoor environments remain under-explored and insufficiently supported (BORKOWSKI & WYSZOMIRSKI 2021). The purpose of this research is to emphasize the importance of utilizing appropriate software tools for LIM and to examine how the current market software addresses specific needs. It aims to investigate the software requirements of landscape architects and analyse the key modelling elements involved in landscape architecture components during the modelling process.

2 Background

2.1 BIM (Building Information Modelling) in Landscape Architecture

In professional landscape architecture practice, BIM is increasingly intersected with workflows that extend beyond traditional design tasks. Large scale projects now require landscape architects to coordinate with architects, engineers, and contractors in shared digital environments where interoperability is critical (BERLATO et al. 2025). BIM participation often means contributing to federated models, aligning grading plans with structural foundations, integrating planting schedules into project databases, and ensuring spatial data remains consistent across disciplines (BEACH et al. 2017).

While there is no single BIM standard dedicated exclusively to landscape architecture (BORKOWSKI & WYSZOMIRSKI 2021) broader frameworks such as ISO 19650, PAS 1192, and buildingSMART's IFC provide applicable guidance (ZHU 2024). Additionally, the book BIM for Landscape by the Landscape Institute (a UK professional body for landscape architecture) (LANDSCAPE INSTITUTE 2016) explains how BIM standards and workflows can be adapted for landscape practice, providing guidance on collaboration, information management, and project delivery.

2.2 Autodesk Revit and Vectorworks Landmark: Overview and Features

Autodesk Revit was originally developed in 1997 by Charles River Software, later renamed Revit Technology Corporation in 2000, before being acquired by Autodesk in 2002 (AUTODESK, INC. 2002). Revit addresses the growing challenges faced by the Architecture, Engineering, and Construction (AEC) industry, particularly those related to coordination, interdisciplinary communication, and change management within projects (MORENO et al. 2019). Unlike AutoCAD, which was based on 2D drafting workflows, Revit was developed as a purpose-built BIM platform. It provides an integrated, data-rich way to manage digital representations of a building's entire lifecycle, including materials, costs, and schedules, to support better decision-making and collaboration among project stakeholders (AUTODESK, INC. n. d.)

Vectorworks was originally developed in the mid-1980s by Diehl Graphsoft in the United States and was later acquired by the Nemetschek Group, a German parent company, in 2000 (VECTORWORKS, INC. n. d. [a]). Initially started as a general-purpose computer-aided design (CAD) platform, Vectorworks has progressively evolved into a comprehensive BIM software suite (ALTIERI 2024). Vectorworks Landmark is a module within the Vectorworks suite that supports landscape professionals by providing workflows for site modelling, hardscape and softscape design, sustainability analysis, and collaboration.

It is a BIM platform that supports every project phase, from pre-design and schematic design to construction documentation, integrating analysis of terrain, drainage, sustainability goals, and cost calculations within a single workflow. Distinguished by its broad interoperability, emerging technology integration, and powerful presentation tools, Landmark enables landscape professionals to design, collaborate, and deliver projects with efficiency and precision (VECTORWORKS, INC. n. d. [b])

2.3 BIM Software Selection and Evaluation

Autodesk Revit and Vectorworks Landmark were chosen for this study due to their strong market presence and distinct relevance to LIM. Industry surveys indicate that Autodesk Revit has emerged as the most widely used BIM platform in the AEC sector, with 50% of respondents identifying it as their primary design tool in the National BIM Report 2020 (NBS ENTERPRISES LTD n. d.). Its widespread adoption has positioned it as the de facto standard for integrated BIM architecture, engineering, and construction. In contrast, Vectorworks Landmark was recognized as one of the first few programs designed specifically for landscape architects, offering specialized tools such as GIS file import, a comprehensive plant database, intelligent planting design, refined hardscape and grading functions, and integrated site modelling with cut-and-fill calculations. According to (PIHLAK 2011), these features enabled landscape architects to produce data-rich, graphically accurate, and fully integrated 3D models, affirming the software's strength as a domain-specific solution

Additionally, comparative reviews from online platforms such as (CAPTERRA n. d.) and (TRUSTRADIUS n. d.) highlight Revit's strength in interdisciplinary BIM workflows and Landmark's usability for design-oriented, landscape-led modelling. Together, these tools represent the most powerful and widely referenced platforms available for BIM-based evaluation in the landscape architecture domain.

Selecting the most appropriate BIM software for landscape architecture projects presents a multidimensional challenge, often complicated by the lack of a universally applicable tool for all project phases. Scholars such as Mordue, Swaddle, and Philp (MORDUE 2016) and Sacks (SACKS 2025) argue that no single BIM platform can address the diverse needs across disciplines and stages of a project. This reality is particularly relevant in LIM, where specific tasks, such as terrain analysis, planting schemes, or site grading require highly specialized tools. The growing diversity of BIM platforms, coupled with overlapping functionalities and varying interoperability capacities, has made software selection increasingly complex (SINGH et al. 2011). To manage this complexity, Multi-Criteria Decision Making (MCDM) methodologies have been widely adopted to provide a structured and transparent decision framework.

2.4 Multi-Criteria Decision Making (MCDM)

MCDM refers to a set of tools and techniques designed to assist in selecting among alternatives when multiple, and often conflicting, criteria must be evaluated simultaneously (TAHERDOOST & MADANCHIAN 2023). These methods allow the integration of qualitative expert judgment with quantitative performance indicators, making them highly applicable in technology selection scenarios. Among MCDM techniques, the Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) are chosen due to their ability to assign weights to evaluation criteria and rank alternatives accordingly. In LIM applications, this dual-method approach is especially beneficial, as it supports informed decision-making by converting subjective expert input into objective, replicable data structures. Thus, using MCDM techniques not only enhances the transparency and traceability of the evaluation process but also ensures that the selected software aligns closely with both professional priorities and technical requirements.

2.5 Analytical Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

The Analytical Hierarchy Process (AHP) is a well-established MCDM method that decomposes complex decision problems into a hierarchical structure comprising goals, criteria, sub-criteria, and alternatives. It employs pairwise comparisons to derive numerical weights, ensuring accountability and consistency in expert judgments (SAATY 2001). The AHP method was adopted as it enables decision-makers to capture relative importance while ensuring that the weights reflect a broad range of expert perspectives for more reliable decision-making (DE FELICE & PETRILLO 2019). In a study by Aladayleh and Aladaileh applied AHP to BIM-based risk management, showing its value in prioritizing strategies and using sensitivity analysis to examine the shifting importance of financial, sustainability, and time-related considerations (ALADAYLEH & ALADAILEH 2024). By converting subjective assessments into quantifiable results, AHP provides a transparent, systematic foundation for subsequent ranking methods, making it especially valuable for this LIM-based comparison of BIM tools.

TOPSIS is an MCDM method introduced by (TZENG & HUANG 2011) in 1981 that ranks alternatives based on their distance from an ideal and a negative-ideal solution. The ideal solution represents the best possible performance across all criteria, while the negative ideal corresponds to the worst. By calculating the geometric distance of each alternative to these two reference points, TOPSIS determines a closeness coefficient that reflects how close an option is to the ideal (SHIH & OLSON 2022). This ranking approach is intuitive and effective, especially when combined with weighted criteria, such as those obtained from AHP (SHARMA et al. 2020). Nursal, Omar, and Nawi (2015) showed that TOPSIS can effectively support BIM software selection by providing a structured process to evaluate multiple criteria and rank alternatives through a web-based system (NURSAL et al. 2015)

2.6 Software Selection by Establishing Evaluation Criteria and Benchmarks

A Norwegian standardization project on BIM for landscape design provided a foundational framework, identifying 38 essential components used in landscape modelling. These elements include terrain features, vegetation types, outdoor furnishings, and structural elements, serving as benchmarks for evaluating BIM tools in landscape architecture (WIK et al. 2018). In a related study, researchers from the Warsaw University of Life Sciences emphasized the integration of GIS in LIM by identifying 14 core elements suitable for modelling within geomatics and land management contexts (BORKOWSKI & WYSZOMIRSKI 2021). Additionally, (ZAHRÁDKOVÁ & ACHTEN 2015) classified landscape elements into a structured information model, delineating them by function and spatial hierarchy within the BIM framework, contributing to a clearer understanding of LIM-specific object types and relationships

An analysis of existing standards and previous studies informed the development of a unified set of modelling benchmarks, representing key landscape components essential to effective LIM. This unified list served as the basis for expert interviews / survey, during which participants were asked to assess the relevance and practical implementation of each component. Insights gathered from these interviews were then used to validate and refine the benchmarks for use in the final evaluation.

3 Research Design

3.1 Research Objectives

- Objective I: To identify and analyse the key landscape architecture components and modelling elements essential for effective LIM
- Objective II: To evaluate and compare the capabilities of Autodesk Revit and Vectorworks in supporting the specific requirements of LIM
- Objective III: To assess the strengths and limitations of both software tools in addressing landscape architects' needs and provide recommendations for software selection in landscape design projects.

3.2 Methodological Framework

This study adopts the Plan-Act-Observe-Reflect (PAOR) framework (COHEN et al. 2007) to systematically evaluate Autodesk Revit and Vectorworks for LIM, integrating both qualitative and quantitative approaches through MCDM methods and expert consultation.

- Plan – The study commenced by clearly defining research objectives and establishing evaluation criteria for LIM, drawing on prior academic frameworks and domain-specific modelling requirements.
- Act – Primary data was collected through expert interviews and survey questionnaire, with AHP and TOPSIS methodologies applied to enable structured multi-criteria evaluation of the selected tools.
- Observe – Collected data were analysed both thematically and quantitatively. Validations were observed and reflected to ensure robustness and reliability of those outcomes.
- Reflect – The findings were synthesized to interpret the comparative performance of Revit and Vectorworks, assess the methodological framework, and develop practical recommendations for BIM adoption in landscape architecture.

4 Data Management/Analysis

The research area of LIM remains highly specialized within the broader discipline of BIM, as conventional CAD-based workflows continue to dominate much of landscape practice. This niche nature of the field posed a significant challenge in participant recruitment. Purposive sampling was therefore employed to ensure the inclusion of participants. The eligibility criteria were as follows:

- Participants must possess a minimum of three years of professional experience using either Autodesk Revit, Vectorworks Landmark, or both.
- Participants must have at least three years of professional experience working as landscape architects.

This criterion was designed to ensure that insights were drawn from practitioners with sufficient exposure to BIM-based tools and their practical applications in landscape workflows. Despite the recruitment challenges to this niche domain, a total of ten expert participants were successfully engaged. Of these, five were experienced primarily in Autodesk Revit, four were experienced primarily in Vectorworks Landmark, and one participant had stronger prior

experience in Vectorworks Landmark but more recent experience working with Autodesk Revit. Interviews were semi-structured in nature and ranged between 45 minutes to one hour in duration. Three interviews were conducted in person, while seven were carried out via online conferencing tools to accommodate geographical and scheduling constraints.

4.1 Interview/Survey Design

Data were collected using a structured questionnaire to guide the semi-structured interviews and systematically record responses. Ethical approval was obtained prior to the study. Participants were provided with a consent form and signed it to confirm their agreement to take part in the survey. A short presentation explained the study aims and evaluation categories, after which participants completed the survey to inform the interview discussion. The questionnaire consisted of four main sections

4.1.1 General Information (Section 1)

This section gathered contextual data on participants' professional background, including their role in landscape architecture, years of experience, and the primary BIM software used.

4.1.2 AHP Pairwise Comparisons (Section 2)

This section was designed to capture the relative importance of seven defined benchmark categories in LIM (e. g., Hardscape and Surfaces, Vegetation and Green Infrastructure, Terrain and Landform, etc). Using the Saaty 1-9 scale, participants compared categories in pairs, enabling the calculation of priority weights through the AHP.

4.1.3 TOPSIS Ratings (Section 3)

This section collected performance ratings for Autodesk Revit and Vectorworks Landmark across detailed sub-criteria within each benchmark category (e. g., pathways, green roofs, stormwater systems). Ratings were given on a five-point Likert scale ranging from "Very poor" to "Excellent," forming the quantitative dataset for the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) analysis.

4.1.4 Additional Feedback (Section 4)

This final section invited open-ended responses to capture qualitative insights, such as perceived strengths or weaknesses of each software, suggestions for missing components, and preferences for future use in LIM workflows.

4.2 Categories

Through literature review and analysis, the seven categories of the modelling elements were identified and their subcategories were refined as follows:

Category Name	Main Elements Included
Hardscape and Surfaces	Paved areas, roads, pathways, stairs, ramps, retaining walls, fencing, kerbs, railings
Vegetation and Green Infrastructure	Trees, shrubs, hedges, lawns, planting beds, green roofs, green walls, irrigation systems

Terrain and Landform	Topography, grading, slopes, cut-and-fill areas, soil conditions
Site Structures and Furniture	Benches, bins, lighting, signage, shelters, gazebos, pergolas, playground equipment
Water and Drainage Systems	Fountains, ponds, stormwater systems, culverts, bioswales, rain gardens
Functional Areas and Data Representation	Activity zones, circulation areas, property boundaries, zoning limits, accessibility routes, Sheets layout, Filters etc
Utilities and Subsurface	Electrical lines, communication lines, plumbing systems, underground infrastructure mapping

4.3 AHP Based Weight Derivation

The Analytic Hierarchy Process (AHP) was employed to determine the relative weights of key landscape categories that inform the multi-criteria decision-making framework. The procedure followed the structured approach proposed by (SAATY 2001) encompassing pairwise comparisons, normalization of the decision matrix, computation of priority weights, and evaluation of consistency. The entire process was implemented in Microsoft Excel, with individual participant responses entered separately.

Participants were required to compare the importance of each category relative to another using Saaty's 9-point scale (1 = equal importance, 3 = moderate importance, 5 = strong importance, 7 = very strong importance, and 9 = extreme importance). Reciprocal values (e. g., 1/3, 1/5) were automatically generated for inverse comparisons to form the pairwise comparison matrix.

The pairwise comparison matrix A was generated by assigning relative importance values to each criterion against all others using the Saaty scale. The structure of this matrix is:

$$A = \begin{bmatrix} 1 & a_{12} & a_{13} & \dots & a_{1n} \\ \frac{1}{a_{12}} & 1 & a_{23} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots & \dots \\ \frac{1}{a_{1n}} & \frac{1}{a_{2n}} & \dots & 1 & \dots \end{bmatrix} \quad (1)$$

Each value in the matrix was normalized by dividing it by the sum of its column:

$$n_{ij} = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}} \quad (2)$$

The priority weight for each criterion was obtained by averaging the normalized values of its row. These weights represent the relative significance of each category and sum to 1 (100%).

$$w_i = \frac{\sum_{j=1}^n n_{ij}}{n} \quad (3)$$

The weighted sum vector was computed by multiplying the original comparison matrix by the derived weight vector. The maximum eigenvalue (λ_{max}) was then calculated as:

$$\lambda_{max} = \frac{\sum \left(\frac{Aw_i}{w_i} \right)}{n} \quad (4)$$

The Consistency Index (CI) and the Consistency Ratio (CR) was determined, where RI is the Random Index value for a matrix of size n (e. g., $RI=1.32$ for $n=7$).

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (5)$$

$$CR = \frac{CI}{RI} \quad (6)$$

During validation, two participants recorded CR values exceeding 20%, indicating inconsistency in their judgments. These participants were contacted to revise their inputs; one successfully corrected their matrices, while one dataset was discarded. As a result, the final analysis was based on nine validated participant datasets. Although Saaty's guideline suggests a CR threshold of 10%, several studies note that when more than six criteria are involved, CR values up to 20% are widely considered acceptable due to the complexity of expert comparisons (SALOMON & GOMES 2024, AMENTA et al. 2020). After conducting pairwise comparisons with nine participants, the normalized weights for each category were averaged to derive the final priority weights.

4.4 TOPSIS Ranking and Analysis

TOPSIS (SHIH & OLSON 2022) was applied to compare the performance of two BIM platforms, Revit and Vectorworks in modelling various landscape and infrastructural elements. The analysis incorporated stakeholder ratings of sub-criteria, combined with AHP-derived weights, to generate a comprehensive ranking of both software options.

A total of nine participants were involved in this stage: four evaluated Revit, four evaluated Vectorworks, and one participant provided ratings for both platforms, owing to prior experience with each. Participants rated each sub-criterion on a 1-5 scale, where 1 represented lowest representational capability and 5 represented highest. Sub-criteria were grouped under seven main categories.

For each platform, a decision matrix $X = [x_{ij}]$ was constructed, where x_{ij} represents the score assigned to alternative i (Revit or Vectorworks) for criterion j (e. g., hardscape, vegetation). The scores were aggregated across respondents for each software to form weighted averages. The decision matrix was normalized using vector normalization:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \quad (7)$$

The normalized matrix was then multiplied by the AHP-derived weights of each criterion to reflect their relative importance:

$$v_{ij} = w_j \cdot r_{ij} \quad (8)$$

The positive ideal solution (A^+) and negative ideal solution (A^-) were identified by selecting the maximum and minimum weighted normalized values for each criterion:

$$A^+ = \max(v_{ij}) \quad (9)$$

$$A^- = \min(v_{ij}) \quad (10)$$

Euclidean distances were computed for each alternative relative to the ideal and negative ideal solutions:

$$S_i^+ = \sqrt{\sum_{j=1}^n (v_{ij} - A_j^+)^2} \quad (11)$$

$$S_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - A_j^-)^2} \quad (12)$$

The closeness coefficient (CC_i) was calculated to rank the alternatives:

$$CC_i = \frac{S_i^-}{S_i^+ + S_i^-} \quad (13)$$

This process enabled a systematic evaluation of both software across all relevant criteria, providing a balanced view that integrates user experience with the relative importance of different design elements in landscape architecture, while ensuring that the final comparison was not solely based on subjective preferences but also grounded in a structured, quantitative framework that enhances the reliability and validity of the results.

5 Findings

The evaluation was conducted in three distinct stages to provide a complete comparison of Revit and Vectorworks in the context of landscape architecture. This layered approach allowed the study to first capture user perceptions, then incorporate the professional priorities of landscape architects, and finally combine these perspectives into a weighted multi-criteria decision-making framework.

5.1 Stage 1: Unweighted User Ratings

The first stage of analysis was based entirely on the raw average ratings provided by participants in Section 3 of the survey. At this stage, no weighting or prioritization of categories was applied, meaning that each category contributed equally to the final comparison.

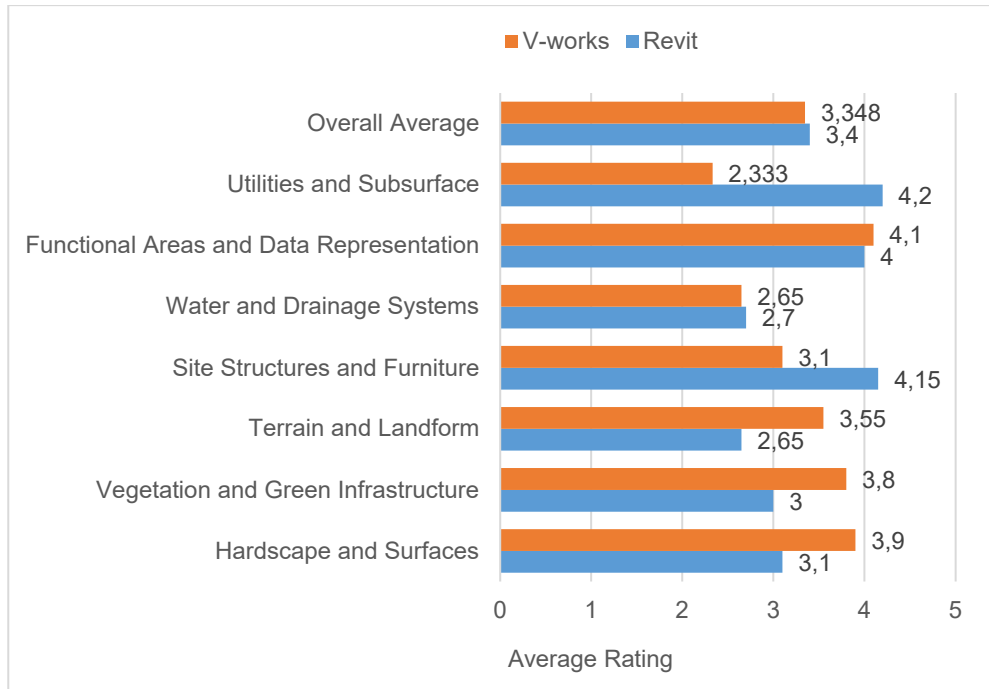


Fig. 1: Unweighted comparison of category ratings for Revit and Vectorworks

The results showed that Revit achieved its highest individual scores in Utilities and Subsurface (4.200), Site Structures and Furniture (4.150), and Functional Areas and Data Representation (4.000). These categories appear to be perceived as areas where Revit offers particularly strong capabilities according to user feedback. Vectorworks, on the other hand, received its strongest ratings in Vegetation and Green Infrastructure (3.800) and Hardscape and Surfaces (3.900), while also performing solid in Terrain and Landform (3.550). When all category scores were averaged, Revit recorded an overall mean score of 3.400, compared to 3.348 for Vectorworks. This suggests that in terms of general user satisfaction, and without considering the differing importance of each category, both software platforms deliver broadly comparable performance, with Revit holding a small numerical advantage.

5.2 Stage 2: AHP-Derived Weightage

The second stage introduced AHP weightings to account for the relative importance of each category from the perspective of professional landscape architects. Respondents were asked to make pairwise comparisons between the categories, and the resulting AHP calculations revealed a distinct hierarchy of importance.

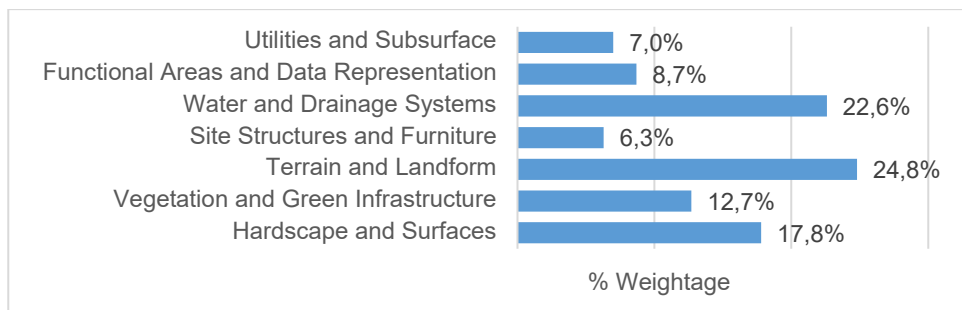


Fig. 2: AHP Category weighting distribution in percentage

Terrain and Landform emerged as the most critical factors, receiving a weight of 25%, while the lowest weights, 7% each were given to Site Structures and Furniture and Utilities and Subsurface. This weighting pattern indicates that features related to core site modelling and hydrological design are valued most highly, while elements such as furnishings and underground utilities, despite their importance in specific projects, are less influential in the overall evaluation. By shifting from equal treatment of categories to this importance-based framework, evaluation better reflect the priorities of the profession.

5.3 Stage 3 – AHP-Weighted TOPSIS Results

The third stage combined the category performance ratings with the AHP-derived weights and applied the TOPSIS.

In this weighted analysis, the rankings shifted noticeably compared to the unweighted results. This reversal can be explained by the fact that Vectorworks performs particularly strongly in Terrain and Landform and Hardscape and Surfaces, both of which have high weightings in the AHP model. Whereas Revit's strongest areas, such as Utilities and Subsurface and Site Structures and Furniture, carry relatively low weightings. Consequently, even though Revit performed well in several categories, those strengths had less influence on the final weighted score. The movement from Stage 1 to Stage 3 highlights the importance of integrating professional priorities into performance evaluation. Without weighting, the differences between Revit and Vectorworks appear small, and Revit shows a slight overall advantage. However, when the priorities of landscape architects are considered, the rankings change substantially, with Vectorworks emerging as the preferred option. Vectorworks achieved a CC of 0.742, placing it first overall, while Revit recorded a CC of 0.671, placing it second. This not only demonstrates the value of AHP in capturing subjective importance but also reveals how some categories, while performing well in raw terms, can have limited impact on the overall outcome if their professional relevance is lower. The shift also suggests that software selection decisions cannot rely solely on user satisfaction ratings, as these may not align with the functional areas that are critical.

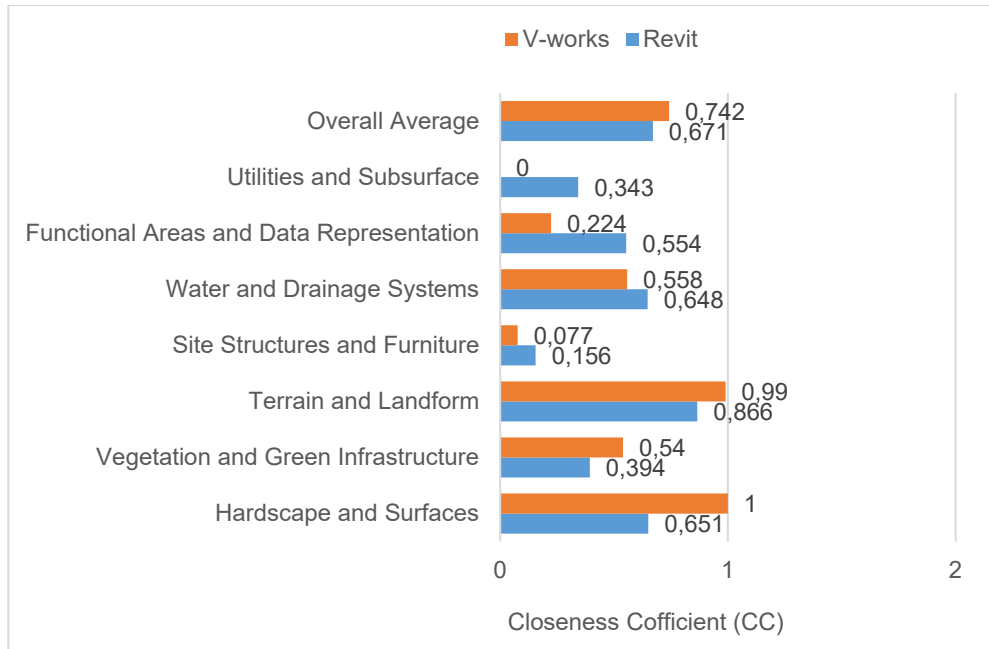


Fig. 3: Closeness Coefficient by Category

6 Discussions

6.1 Interpretation of Quantitative and Qualitative Results

Quantitatively, the Stage 1 results showed only small differences between the two platforms when evaluated using unweighted average ratings, with Revit achieving a slight numerical advantage overall. However, this changed once the AHP (Stage 2) and the AHP weighted TOPSIS method (Stage 3) were applied, which placed greater emphasis on the categories that professionals rated as most important. Qualitative feedback from survey participants adds important context to these quantitative results. A clear pattern emerged showing that participants' professional background, project type, and sector influenced how they prioritized the evaluation categories. For example, one Revit user who works as a landscape architect on large-scale data center projects placed the greatest emphasis on Utilities and Subsurface focus area that falls outside the priorities of most landscape architects but is critical for their specialized field. Another Revit user, whose works more on master planning prioritized Zones, Functional Areas and Data Representation, reflecting the importance of spatial organization and visual clarity at early design stages. Meanwhile, respondents engaged more heavily in construction documentation tended to assign greater importance to Hardscape and Surfaces, given its direct relevance to buildability and specification detail. This variation in professional priorities helps explain why some categories that scored highly in the raw average had relatively low influence in the weighted TOPSIS results.

Overall, this divergence between raw scores and weighted rankings underscores a central finding: a platform's perceived overall value is not determined solely by its average perfor-

mance, but by how well its strengths align with the dominant priorities of the individual profession. Revit continues to excel in technically detailed, infrastructure-oriented tasks, while Vectorworks aligns more closely with high-priority landscape design workflows.

6.2 Practical Implications for LIM Software Selection

The combined AHP-TOPSIS framework applied in this study highlights how the suitability of a LIM platform is not solely determined by general user satisfaction scores but is strongly influenced by the specific functional priorities of the intended project context. The results demonstrate that Vectorworks offer advantages in categories with high professional weighting such as Terrain and Landform and Hardscape and Surfaces, while Revit shows relative strengths in areas like Utilities and Subsurface and Site Structures and Furniture, which, although important, carry lower weighting in the aggregated professional priority model. These findings suggest that decision-makers should begin the software selection process by understanding the relative importance of functional categories in their project. Where projects demand topographical modelling, hydrological design, and hardscape representation, platforms excelling in those domains are likely to deliver greater overall value. Conversely, for projects where underground infrastructure modelling, subsurface utilities coordination, and furniture placement are central, software that performs strongly in those areas may be more appropriate.

6.3 Methodological Reflection

The methodology adopted in this study combined user satisfaction ratings, AHP weighting, and the TOPSIS to evaluate two BIM platforms in the context of landscape architecture. This multi-stage approach allowed for a layered analysis, beginning with raw user perceptions, progressing through the identification of professional priorities, and finally in a weighted multi-criteria ranking. One of the methodological strengths lies in the integration of both quantitative survey data and qualitative insights from interviews. This dual approach ensured that the evaluation considered not only numerical performance measures but also the practical realities and contextual factors that influence software adoption in the field. Furthermore, the use of AHP brought transparency to the process of determining category importance, while TOPSIS offered a structured and mathematically robust way of translating these priorities into comparative rankings. In the AHP stage, the weighting relied on subjective pairwise judgments, which can be influenced by participants' specific professional backgrounds, project types, and levels of familiarity with each platform.

In implementing AHP, the Consistency Ratio (CR) was kept below 20%, which exceeds the conventional 10% threshold recommended by Saaty. Several methodological sources note that CR values of up to 20% are acceptable for models with more than six criteria, provided the judgments are logically consistent and supported by qualitative context. While this adjustment allowed for the inclusion of all seven categories without overburdening participants, it does introduce some additional variability into the weighting process, a factor that should be considered when interpreting the results.

6.4 Limitations of the Study

While this research provides a structured comparison of Revit and Vectorworks for landscape modelling, several important aspects remain outside its scope. The study does not fully ad-

dress the dynamic ecological processes of landscapes, which unlike static buildings, are living systems that grow, evolve, and transform with seasonal changes, climate conditions, and long-term ecological succession.

Critical sustainability factors such as biodiversity net gain (BNG), carbon footprint assessments, and broader ecosystem service evaluations were also beyond the scope of this analysis, despite their increasing relevance in landscape practice and environmental policy. Similarly, interoperability and coordination challenges, particularly the integration of BIM platforms with GIS data, ecological modelling tools, and civil engineering systems were acknowledged but not examined in detail. These integrations are increasingly critical for large-scale, data-rich projects. The research was conducted in a niche professional area, which meant the participant pool was necessarily small: only nine individuals took part, with five datasets each for Revit and Vectorworks (including one participant who evaluated both platforms). Although this was sufficient for applying the combined AHP–TOPSIS framework, the small sample size constrains the statistical robustness of the findings.

These limitations highlight avenues for future research, particularly the need for holistic frameworks that combine dynamic ecological modelling with sustainability metrics and cross-disciplinary data coordination, enabling LIM to fully capture the living and evolving nature of outdoor environments.

7 Conclusion

This research shows that the suitability of BIM platforms for LIM depends less on the number of features they offer and more on how well they meet the specific needs of the discipline. By combining AHP derived weights with TOPSIS rankings, the study provides a practical method for evaluating software based on both performance and professional priorities. The results show that being widely used in general BIM workflows does not guarantee that a platform will be the best fit for landscape projects, where key functions, such as terrain modelling, water management, and hardscape design can influence the outcome.

The main contribution is a clear, priority-based evaluation process that can be adapted for other specialist BIM uses, helping to make software selection more transparent and better supported. For practice, the findings highlight the importance of defining functional needs before choosing a platform, focusing on how well it supports the essential outputs of landscape architecture. Beyond Revit and Vectorworks, this approach can help guide future choices as sustainability, ecological modelling, and data integration become a larger part of the profession.

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