A User-reviewed Multi-Criteria Framework for Evaluating Computer-aided Design Software Popular in the Woodworking Industry

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A Multi-Criteria Decision Making (MCDM) approach is proposed to replace expert inputs with publicly available user-based evaluation data from Capterra and G2. Five computer-aided design (CAD) alternatives used in the woodworking industry (SketchUp, Autodesk Fusion, SOLIDWORKS, Rhinoceros, and Autodesk Inventor) were identified through a review of 14 online industry sources and evaluated using five criteria: customer satisfaction, ease of use, features, customer service, and cost. Criteria weights were calculated using the Criteria Importance Through Intercriteria Correlation (CRITIC) method, and alternatives were ranked using the Evaluation based on Distance from Average Solution (EDAS) method. SketchUp ranked first with an Appraisal Score (AS) of 0.9877, followed by Rhinoceros (0.8490), Autodesk Fusion (0.6472), Autodesk Inventor (0.4212), and SOLIDWORKS (0.0528). The robustness of the results was supported by sensitivity analysis and comparative analysis using Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Simple Additive Weighting (SAW), and the VIseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR). Thus, user review data can be used as structured input for MCDM and applies CRITIC-EDAS framework to CAD software popular in the woodworking industry, using publicly available user-review data. The proposed framework offers a transparent and reproducible alternative to expert-based CAD selection approaches.

DOI: 10.15376/biores.22.1.275-296

Keywords: CAD software selection; MCDM; CRITIC; EDAS; Woodworking industry; User reviews

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INTRODUCTION

Enterprises are required to adapt to market dynamics and to technological advancements to stay competitive and to survive. This is especially important in sectors that experience short product life cycles and frequent trend shifts. Furniture design and manufacturing, a trend-driven industry (Bumgardner *et al.* 2001), requires frequent updates in designs and production processes. To that end, Computer-Aided Design (CAD) software enables design iterations, modifications, analyses, and optimizations (Narayan *et al.* 2008), allowing firms to respond to accelerating market change and growing customer expectations (Tan and Vonderembse 2006). In this study, the term "woodworking industry" refers to both woodworking and furniture manufacturing. According to Kannan and Vinay (2008), the main purposes of using CAD are producing higher quality products through minimizing design errors, solving complex design problems through computer-based

analyses, such as finite element analysis (FEA), and shortening the time spent on design processes, thereby reducing labor costs. Erdinler Gözlüklüoğlu (2005) lists the following benefits of CAD software: faster drawing production (Hawkes 1988); greater drawing accuracy, enabling more detailed work through features such as zoom; cleaner drawings, producing consistent outputs regardless of the user's style; no redundant redrawing, as modifications can be made without recreating the entire drawing; faster calculations and analyses, where software support covers dimensioning to cost estimation; error reduction, as simulations shorten prototyping and lead to lower costs; and integration with other departments, allowing designs to be directly transferred into production. In the woodworking and furniture context, CAD software takes design inputs such as dimensions, geometry, joinery details, and material specifications, and turns them into outputs that serve both design and production. A CAD design for furniture is typically expressed through orthographic views (main, top, and side) from which the parts to be produced can be clearly understood (Dan 2017). Beyond such drawings, the outputs include three-dimensional models, renderings, material lists, and machine-readable files that can be passed to other systems: parametric CAD models, for example, are commonly exported (*e.g.*, in IGES format) for finite element analysis and shape optimization (Scurtu et al. 2015). In practice, many manufacturers use CAD mainly for product engineering and for programming their computer numerical control (CNC) machines (Hagström *et al.* 2006), and it becomes even more useful once it works together with computer-aided manufacturing (CAM) systems (Erdinler and Koç 2024). Because packages differ in what they emphasize (some in free-form modeling, others in parametric or production-oriented detailing), the software that fits best depends on the specific design and manufacturing workflow of the company. This variation is one of the reasons a structured, multi-criteria approach to software selection is needed. Thus, CAD software provides large benefits, and no woodworking and furniture company could do without it. However, enterprises encounter a decision-making problem to find the best-fitting CAD software. Numerous CAD software alternatives can be found with different feature sets, licensing models, and costs. Although CAD systems can be cheaply acquired through free and open-source versions (Junk and Kuen 2016), commercially licensed CAD packages come with high costs (Isra *et al.* 2025), which can be seen as a major barrier for SMEs that have resource constraints (Eller *et al.* 2020). However, improper choice of software can have adverse effects on the business, resulting in economic losses or worse (Jadhav and Sonar 2009), emphasizing the need for a systematic and scientific approach to the CAD software selection problem.

Various Multi-Criteria Decision Making (MCDM) methodologies have been used to address the problem of CAD software selection. Kannan and Vinay (2008) used the Analytic Hierarchy Process (AHP) to evaluate four CAD/CAM software packages for a small manufacturing firm. Similarly, Zakria *et al.* (2010) proposed an AHP-based framework for CAD/CAM selection for Pakistani SMEs and validated the results through Expert Choice software. Bataineh *et al.* (2018) proposed an AHP-based model for mechanical design applications using the Expert Choice software. Ayağ (2010) applied a fuzzy AHP methodology to select the most suitable CAD software from five alternatives. Roshanaei *et al.* (2013) developed a hybrid fuzzy MCDM model that combined AHP and The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) for CAD/CAM selection. More recently, Simanavičienė and Vdovinskienė (2023) also used AHP with expert input for the selection of CAD software. Thus, the relevant literature mostly includes studies on the CAD software selection problem that predominantly relied on AHP-based approaches for a solution, which inherently depends on subjective pairwise

comparisons by decision-makers or domain experts. Beyond software selection, MCDM methods have also been applied more broadly in the woodworking and furniture domain (for example, to assess the contribution of different furniture products to the national economy using a hybrid entropy–ELECTRE model (Ersen 2021)), which shows the suitability of such methods for decision problems in this field.

Three gaps still exist in the literature: First, most studies were based on expert opinion as the primary data source. This approach is costly, time-consuming, and prone to individual bias. It is also difficult to replicate a study across different contexts (Al Fozaie and Wahid 2022; Repetski *et al.* 2022). Second, to the best of the author's knowledge, none of the previous studies focused on CAD software commonly used in the wood processing and furniture industry. This study therefore focuses on software that is popular within this industry, identified as the intersection of software visible in sector-oriented sources and software with sufficient user-review data on general-purpose platforms, while acknowledging that the underlying ratings are not industry-filtered. Third, CAD software selection has been commonly addressed using AHP-based methods. Alternative MCDM approaches, such as the Criteria Importance Through Intercriteria Correlation (CRITIC) method for objective weight determination and the Evaluation based on Distance from Average Solution (EDAS) for ranking, have not yet been explored in this context.

This study addresses these three research gaps discussed above using user-input data by applying MCDM methods, specifically CRITIC for objective criteria weighting and EDAS for alternative ranking. Instead of acquiring expert opinions, publicly available data from Capterra (2026) and G2 (2026a) were used. These software review platforms provide numerous user reviews across multiple aspects. The data obtained was processed through the proposed CRITIC-EDAS hybrid model. CRITIC (Diakoulaki *et al.* 1995) provides objective criteria weights based on the statistical properties of the decision matrix. EDAS, developed by Keshavarz Ghorabaee *et al.* (2015), ranks alternatives by their distance from the average solution, which is particularly suitable for cases where no alternative dominates across all criteria. Hence, this study employs publicly available user-review data that can be used as a structured input for MCDM methodologies, thereby providing a repeatable alternative to expert-based approaches. The novelty of this work lies in applying the CRITIC-EDAS framework, using publicly available user review data, to evaluate CAD software that is popular in woodworking industry. To best of the author's knowledge, this combination has not been applied to this software group before. The outcome is intended as a preliminary, reproducible screening reference to support companies that may lack the time and resources for expert consultation, rather than as a definitive selection tool.

EXPERIMENTAL

The proposed methodology consists of steps for examining widely used CAD software in the woodworking industry. A four-step approach was followed: identification of CAD software alternatives; determination of evaluation criteria; application of objective weighting of criteria using CRITIC; and finally, ranking of alternatives using EDAS.

Identification of Software Alternatives

In January 2026, web sources were scanned to identify popular CAD software used in the woodworking sector. First, academic databases (Web of Science and Scopus) were

roughly searched to find which CAD software can be popular in the sector, but no satisfying results were obtained. To that end, web sources that may reflect real-world visibility and adoption of relevant software were scanned. For this purpose, the words "CAD software," "woodworking," "furniture design," "3D modeling," and "cabinet design" were searched in different combinations (such as "best CAD software for woodworking," "furniture design software," and "furniture CAD/s"). Because general web searches return results in decreasing order of relevance, the first few results pages were screened; beyond these, the results became increasingly unrelated to the topic. Sources were retained if they listed or compared multiple CAD software products relevant to woodworking or furniture applications. Sources were disregarded if they did not address this domain, promoted a single vendor's product, or consisted of direct sales or advertising pages. This process yielded 14 sources (listed in the Appendix). It should be noted that this web-based screening is not equivalent to a systematic database review; it was adopted because practitioner adoption of CAD software is primarily reflected in such sources. If the same software name appeared in the same source more than once (such as appearing three times in a specific source), it was counted only once. The purpose was to determine in how many different sources each software was listed. Once the name of a CAD software had been determined, user feedback on Capterra and G2 was examined. These two platforms provide quantitative ratings derived from verified users' reviews. Capterra has more than 2.5 million verified users (Capterra 2024), and G2 has been used by more than 90 million people annually (G2 2026a) and they are the two major platforms for software evaluation. Both platforms have identity verification and conflict of interest checks (Capterra 2024; G2 2026b; G2 2026c) to ensure real user evaluations and reviews. While Capterra provides more detailed rating scales (*i.e.*, separate ratings for Ease of Use, Features, *etc*.) G2 does not provide such criteria-level ratings. Therefore, G2 was used only to quantify each software's review volume for the popularity screening. To that end, all criteria ratings used in the decision matrix were obtained from Capterra. The reliability of an aggregate rating depends on the number of underlying reviews. An average based on very few reviews is highly volatile and susceptible to individual bias, and it stabilizes only after a sufficient number of reviews has accumulated (Xie and Lui 2013; Minard 2016). To the best of the author's knowledge, there is no single, universally agreed-upon minimum number of reviews for a reliable average; however, empirical analyses report that aggregate ratings typically stabilize within a range of roughly a few dozen to about 150 reviews, depending on the product category (Minard 2016). On this basis, a software item was included in the evaluation only if it had accumulated a substantial volume of user reviews. This review-volume requirement also served to reduce the influence of marketing or search-engine-optimized content, since only software with substantial, independently verified user feedback entered the evaluation. All software retained for the analysis exceeded 280 combined reviews across the two platforms, which is at or above the range associated with stabilized aggregate ratings. SketchList 3D, by contrast, had only 29 combined reviews, below the level at which an aggregate rating can be considered reliable, and it was therefore excluded from the analysis.

Determination of Evaluation Criteria

To avoid subjective expert evaluation input, the criteria were limited to those that are directly and quantitatively rated by users on Capterra and G2 and that are also recurrent in the MCDM software-selection literature. Five criteria were adopted: C1. Customer Satisfaction (Bataineh *et al.* 2018; Patel *et al.* 2021); C2. Ease of Use (Ayağ and Özdemir

2007; Benlian and Hess 2011; Kaur and Singh 2014; Bataineh *et al.* 2018; Puzovic *et al.* 2019); C3. Features (Kaur and Singh 2014; Puzovic *et al.* 2019); C4. Customer Service (Sahay and Gupta 2003; Benlian and Hess 2011; Zaidan *et al.* 2015); and C5. Cost (Sahay and Gupta 2003; Ayağ and Özdemir 2007; Benlian and Hess 2011; Kazancoglu and Burmaoglu 2013; Kaur and Singh 2014; Hanine *et al.* 2016; Bataineh *et al.* 2018;).

C1 to C4 are benefit criteria (higher values are preferred), while C5 (Cost) is a cost criterion (lower values are preferred). Cost data were obtained from the official websites of the respective software vendors as of January 2026. To make a consistent evaluation, similar plans were selected. When available, the most comprehensive single-user plan was chosen for each alternative. For example, Rhinoceros 8 is available as a single-user license (€995), a 10-user license (€9,950), and a 50-user license (€49,750). The single-user option was selected. Similarly, SketchUp Studio ($819/year), Autodesk Fusion including the Design Extension ($1,752/year), SOLIDWORKS Design Premium with Cloud Services ($4,716/year), Rhinoceros 8 single-user perpetual license (€995, converted to $1,162 at the January 2026 exchange rate), and Autodesk Inventor annual subscription ($2,585/year) were chosen. It should be noted that different licensing plans are available for different needs, and selecting a different plan based on an organization's requirements would result in different cost values and, potentially, different rankings. Furthermore, the alternatives differ in their licensing models: SketchUp, Autodesk Fusion, SOLIDWORKS, and Autodesk Inventor are offered as annual subscriptions, whereas Rhinoceros is sold as a one-time perpetual license. In the base decision matrix, the first-year expenditure was used for all alternatives; because the licensing models differ, a multi-year total cost of ownership scenario is examined in the Comparative Results section.

CRITIC Method for Criteria Weighting

In MCDM problems, criteria weights can be either subjective (derived from decision-maker or expert judgments) or objective (derived from the statistical properties of the decision matrix (Diakoulaki *et al.* 1995; Liu *et al.* 2015). Subjective weights can be stated as the perception of relative importance of decision-makers (Goldstein 1990), which makes the data open to bias and difficult to reproduce. To address these limitations, objective weighting methods, including Entropy, Standard Deviation, and the criteria weights, and objective calculation (CRITIC) method were applied (Keshavarz-Ghorabaee *et al.* 2018). For this study, the CRITIC method (Diakoulaki *et al.* 1995) was employed and the standard deviation of each criteria and the correlation among criteria were evaluated (Diakoulaki *et al.* 1995; Yilmaz and Harmancioglu 2010). The CRITIC procedure consists of the following four steps:

Step 1: Normalization of the decision matrix. For benefit criteria:

$$r_{ij} = \frac{x_{ij} - x_j^{\min}}{x_j^{\max} - x_j^{\min}} \quad (1)$$

For cost criteria:

$$r_{ij} = \frac{x_j^{\max} - x_{ij}}{x_j^{\max} - x_j^{\min}} \quad (2)$$

where x_{ij} is the value of alternative i for criteria j, and $x_j^{\max}$ and $x_j^{\min}$ are, respectively, the maximum and minimum values of criteria j.

Step 2: Computation of inter-criteria correlations:

$$\rho_{jk} = \frac{\sum_{i=1}^{m}(r_{ij}-\bar{r}_j)(r_{ik}-\bar{r}_k)}{\sqrt{\sum_{i=1}^{m}(r_{ij}-\bar{r}_j)^2 \cdot \sum_{i=1}^{m}(r_{ik}-\bar{r}_k)^2}} \quad (3)$$

Step 3: Computation of the information content c_j:

$$\sigma_j = \sqrt{\frac{\sum_{i=1}^{m}(r_{ij}-\bar{r}_j)^2}{m}} \quad (4)$$

$$c_j = \sigma_j \sum_{k=1}^{n}(1-\rho_{jk}) \quad (5)$$

Step 4: Computation of criteria weights:

$$w_j = \frac{c_j}{\sum_{k=1}^{n} c_k} \quad (6)$$

EDAS Method for Ranking

After the application of an objective weighting of the criteria using CRITIC (Diakoulaki *et al.* 1995), the ranking of alternatives was undertaken using the EDAS method by Keshavarz Ghorabaee *et al.* (2015). Unlike TOPSIS and VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR), which rely on distances to ideal and anti-ideal solutions, the EDAS method evaluates alternatives based on their distance from the average solution. However, proximity to an ideal solution does not always guarantee the best alternative. Therefore, EDAS is particularly well-suited to problems in which no single alternative dominates all others (Torkayesh *et al.* 2023). The method consists of seven steps.

Step 1: Construction of the decision matrix:

$$X = [x_{ij}]_{m\times n} \quad (7)$$

Step 2: Determination of the average solution (AV):

$$AV_j = \frac{\sum_{i=1}^{m} x_{ij}}{m} \quad (8)$$

Step 3: Computation of the positive (PDA) and negative (NDA) distance matrices. For benefit criteria:

$$PDA_{ij} = \frac{\max(0, x_{ij}-AV_j)}{AV_j} \quad (9)$$

$$NDA_{ij} = \frac{\max(0, AV_j-x_{ij})}{AV_j} \quad (10)$$

For cost criteria:

$$PDA_{ij} = \frac{\max(0, AV_j-x_{ij})}{AV_j} \quad (11)$$

$$NDA_{ij} = \frac{\max(0, x_{ij}-AV_j)}{AV_j} \quad (12)$$

Step 4: Computation of weighted sums SP and SN:

$$SP_i = \sum_{j=1}^{n} w_j \cdot PDA_{ij} \quad (13)$$

$$SN_i = \sum_{j=1}^{n} w_j \cdot NDA_{ij} \quad (14)$$

Step 5: Normalization of SP and SN:

$$NSP_i = \frac{SP_i}{\max_i(SP_i)} \quad (15)$$

$$NSN_i = 1 - \frac{SN_i}{\max_i(SN_i)} \quad (16)$$

Step 6: Computation of the appraisal score (AS):

$$AS_i = \frac{1}{2}(NSP_i + NSN_i), \quad 0 \le AS_i \le 1 \quad (17)$$

Step 7: Ranking. Alternatives are sorted in descending order of AS_i; the alternative with the highest score is the most preferred.

RESULTS AND DISCUSSION

Identification of CAD Software in the Woodworking Industry

Following the approach described earlier, the fourteen web-based sources examined (Appendix) were used to create Table 1, which shows the name of the CAD Software reviewed.

Table 1. Woodworking and Furniture Design CAD Software Identified Through Online Reviews and Web Articles

Source	SketchUp	SketchList 3D	Autodesk Fusion	SOLIDWORKS	Autodesk Inventor	Pro100	Rhinoceros	CADPro
W1	x	x						
W2	x	x	x	x	x			
W3	x	x	x	x	x	x	x	
W4	x	x		x				
W5	x	x		x	x	x	x	x
W6	x	x	x	x	x		x	x
W7			x	x			x	
W8	x		x	x				
W9	x		x	x			x	
W10			x	x	x			
W11	x	x		x	x	x	x	x
W12	x		x			x		
W13	x	x	x	x	x	x	x	x
W14	x	x		x	x	x	x	x
Total	**12**	**9**	**9**	**12**	**8**	**6**	**8**	**5**

Note: W1 to W14 are web-based industry reviews and comparison guides. Full references are provided in Appendix

User-review counts were obtained from Capterra and G2 platforms (Table 2). To that end, SketchUp leads with a combined 2,360 reviews, followed by SOLIDWORKS (1,376), Autodesk Fusion (772), Autodesk Inventor (713), and Rhinoceros (280).

SketchList 3D, despite its frequent appearance in industry sources, has only 29 user reviews and was therefore excluded from this study.

Table 2. User-review Counts of Woodworking and Furniture-design Software (Capterra and G2, January 2026)

Platform	Autodesk Fusion	Autodesk Inventor	Rhinoceros	SketchList 3D	SketchUp	SOLIDWORKS
Capterra	268	276	92	13	1,041	753
G2	504	437	188	16	1,319	623
Total	**772**	**713**	**280**	**29**	**2,360**	**1,376**

Based on the combined user-review count in Capterra and G2 (Table 2), the five alternative CAD software selected for this analysis are SketchUp, Autodesk Fusion, SOLIDWORKS, Rhinoceros, and Autodesk Inventor.

Decision Matrix

To form the decision matrix, user reviews were needed. In this case, the Capterra and G2 platforms were used. In addition to the number of reviews on Capterra, the G2 platform was used to quantify the volume of users. The required data for criteria (in this case 1 to C4) were obtained through Capterra. The required data (user ratings, costs, *etc.*) were checked on 12 January 2026. Cost data were collected from the official websites of the specific vendors. The Rhinoceros price was originally listed in EUR (€995) and converted to USD using the current exchange rate at the time of data collection (1.17 USD/€). The resulting decision matrix is presented in Table 3.

Table 3. Decision Matrix for the Five Alternatives Across the Five Criteria

Alternative		C1 Customer Satisfaction	C2 Ease of Use	C3 Features	C4 Customer Service	C5 Cost (USD)
A1	SketchUp	4.5	4.4	4.3	4.1	819
A2	Autodesk Fusion	4.5	4.1	4.5	4.1	1,752
A3	SOLIDWORKS	4.6	4.4	4.7	4.2	4,716
A4	Rhinoceros	4.6	4.0	4.4	4.1	1,162
A5	Autodesk Inventor	4.5	4.2	4.5	4.1	2,585
*C1 to C4 are benefit criteria obtained from Capterra (higher values preferred); C5 is a cost criterion obtained from vendor websites (lower values preferred)						

CRITIC Weighting

Applying Eqs. 1 and 2, the decision matrix was normalized (Table 4). Inter-criteria correlations were then computed using Eq. 3 and the resulting correlation matrix is reported in Table 5.

Table 4. Normalized Decision Matrix

	C1	C2	C3	C4	C5
A1	0.0000	1.0000	0.0000	0.0000	1.0000
A2	0.0000	0.2500	0.5000	0.0000	0.7606
A3	1.0000	1.0000	1.0000	1.0000	0.0000
A4	1.0000	0.0000	0.2500	0.0000	0.9120
A5	0.0000	0.5000	0.5000	0.0000	0.5468

Table 5. Inter-criteria Correlation Matrix

	C1	C2	C3	C4	C5
C1	1.0000	−0.1021	0.4308	0.6124	−0.4300
C2	−0.1021	1.0000	0.2073	0.5625	−0.4304
C3	0.4308	0.2073	1.0000	0.8292	−0.9585
C4	0.6124	0.5625	0.8292	1.0000	−0.9024
C5	−0.4300	−0.4304	−0.9585	−0.9024	1.0000

C5 (Cost) exhibits a strong negative correlation with the four qualitative criteria, particularly with C3 (Features, −0.96) and C4 (Customer Service, −0.90), indicating that more expensive software tends to offer richer features and better support. Standard deviations (σ_j) and information-content values (c_j) were computed using Eqs. 4 and 5, and final weights (w_j) were computed using Eq. 6. The results are reported in Table 6.

Table 6. CRITIC Weighting Results

Criteria	σ_j	$\sum(1-\rho_{jk})$	c_j	w_j
C1 Customer Satisfaction	0.4899	3.4889	1.7092	**0.2156**
C2 Ease of Use	0.4000	3.7627	1.5051	**0.1898**
C3 Features	0.3317	3.4912	1.1579	**0.1460**
C4 Customer Service	0.4000	2.8984	1.1594	**0.1462**
C5 Cost	0.3567	6.7214	2.3978	**0.3024**
Sum			**7.9294**	**1.0000**

C5 (Cost) receives the highest weight (0.3024), followed by C1 (Customer Satisfaction, 0.2156), C2 (Ease of Use, 0.1898), C4 (Customer Service, 0.1462), and C3 (Features, 0.1460). These results were derived from the structural properties of the decision matrix, as four decision criteria based on user input have a narrow range between 4.0 and 4.7, while licensing costs have a wider range between 819 USD and 4,716 USD. Therefore, the CRITIC method reveals Cost as the most informative, that is, the most discriminating criteria.

EDAS Ranking

The decision matrix from Table 3 was used to compute the average solution vector (Eq. 8): AV = [4.54, 4.22, 4.48, 4.12, 2,206.8]. Positive and negative distance matrices (PDA and NDA) were then computed using Eqs. 9 to 12; the results are presented in Tables 7 and 8.

Table 7. Positive Distance from Average (PDA) Matrix

	C1	C2	C3	C4	C5
A1	0.0000	0.0427	0.0000	0.0000	0.6289
A2	0.0000	0.0000	0.0045	0.0000	0.2061
A3	0.0132	0.0427	0.0491	0.0194	0.0000
A4	0.0132	0.0000	0.0000	0.0000	0.4734
A5	0.0000	0.0000	0.0045	0.0000	0.0000

The weighted sums of positive distances (SP) and negative distances (SN), the normalized values and their normalized counterparts (NSP and NSN), the appraisal score (AS), and the final ranking, computed using Eqs. 13 to 17, are reported in Table 9.

Table 8. Negative Distance from Average (NDA) Matrix

	C1	C2	C3	C4	C5
A1	0.0088	0.0000	0.0402	0.0049	0.0000
A2	0.0088	0.0284	0.0000	0.0049	0.0000
A3	0.0000	0.0000	0.0000	0.0000	1.1370
A4	0.0000	0.0521	0.0179	0.0049	0.0000
A5	0.0088	0.0047	0.0000	0.0049	0.1714

Table 9. EDAS Results: Weighted Sums (SP, SN), Normalized Values (NSP, NSN), Appraisal Scores (AS), and Final Rankings

Alternative	SP_i	SN_i	NSP_i	NSN_i	AS_i	**Rank**
A1 SketchUp	0.1983	0.0085	1.0000	0.9753	**0.9877**	**1**
A2 Autodesk Fusion	0.0630	0.0080	0.3176	0.9767	**0.6472**	**3**
A3 SOLIDWORKS	0.0210	0.3438	0.1057	0.0000	**0.0528**	**5**
A4 Rhinoceros	0.1460	0.0132	0.7365	0.9616	**0.8490**	**2**
A5 Autodesk Inventor	0.0007	0.0553	0.0033	0.8391	**0.4212**	**4**

Thus, the final ranking is SketchUp > Rhinoceros > Autodesk Fusion > Autodesk Inventor > SOLIDWORKS.

Sensitivity Analysis

In decision-making problems, input data can be imprecise and subject to change over time, which makes it necessary to test the robustness of the results through sensitivity analysis (Triantaphyllou and Sánchez 1997). Sensitivity analysis was conducted using a one-at-a-time (OAT) approach, in which each criterion weight was individually changed by ± 20% and ± 40%, while the remaining weights were proportionally adjusted to maintain a total sum of one. A total of 20 scenarios were performed (5 criteria × 4 levels of adjustment). This approach allows the individual influence of each criteria on the final ranking to be assessed independently. The results obtained are shown in Table 10. In all scenarios calculated, the rankings remained unchanged. However, the invariance of the ranking under weight changes should be interpreted with caution, as the CRITIC weights are themselves derived from the data structure; this weight-based analysis is therefore complemented by an additional test on the decision-matrix values themselves, described below.

Because the CRITIC weights are derived from the data structure, an additional analysis was performed by modifying the decision-matrix values rather than the weights. Since the qualitative ratings (C1 to C4) fall within a narrow band (4.0 to 4.7), an extreme scenario was tested in which all qualitative ratings were set to the same value (*i.e.*, treated as indistinguishable within measurement uncertainty), leaving cost as the only differentiating criterion. Under this scenario, the ranking did not change (SketchUp > Rhinoceros > Autodesk Fusion > Autodesk Inventor > SOLIDWORKS). In other words, even when the small differences among the user ratings are ignored, the same order emerges, because the cost values alone are enough to separate the alternatives. The stability observed here therefore comes from the structure of the data, cost values are widely dispersed while the ratings sit in a narrow band, and not from the method itself.

Table 10. Sensitivity Analysis Results: Appraisal Scores under ±20% and ±40% Weight Adjustments

Scenario		SketchUp	Fusion	SOLIDWORKS	Rhinoceros	Inventor	Ranking Change
	Original	0.9877	0.6472	0.0528	0.8490	0.4212	-
S1	**C1 +20%**	0.9869	0.6464	0.0548	0.8510	0.4204	No
S2	**C1 −20%**	0.9883	0.6478	0.0511	0.8473	0.4218	No
S3	**C1 +40%**	0.9861	0.6456	0.0570	0.8531	0.4196	No
S4	**C1 −40%**	0.9889	0.6484	0.0495	0.8457	0.4224	No
S5	**C2 +20%**	0.9877	0.6435	0.0575	0.8414	0.4208	No
S6	**C2 −20%**	0.9877	0.6506	0.0485	0.8560	0.4215	No
S7	**C2 +40%**	0.9877	0.6394	0.0626	0.8332	0.4204	No
S8	**C2 −40%**	0.9877	0.6537	0.0444	0.8624	0.4218	No
S9	**C3 +20%**	0.9856	0.6476	0.0572	0.8481	0.4216	No
S10	**C3 −20%**	0.9896	0.6468	0.0488	0.8499	0.4208	No
S11	**C3 +40%**	0.9834	0.6480	0.0619	0.8471	0.4220	No
S12	**C3 −40%**	0.9914	0.6464	0.0449	0.8507	0.4205	No
S13	**C4 +20%**	0.9874	0.6469	0.0546	0.8488	0.4209	No
S14	**C4 −20%**	0.9879	0.6474	0.0512	0.8493	0.4214	No
S15	**C4 +40%**	0.9872	0.6466	0.0564	0.8485	0.4207	No
S16	**C4 −40%**	0.9881	0.6476	0.0497	0.8495	0.4216	No
S17	**C5 +20%**	0.9906	0.6511	0.0406	0.8555	0.4220	No
S18	**C5 −20%**	0.9833	0.6413	0.0707	0.8394	0.4199	No
S19	**C5 +40%**	0.9927	0.6540	0.0317	0.8602	0.4226	No
S20	**C5 −40%**	0.9759	0.6316	0.0995	0.8234	0.4178	No

Comparative Results

A comparative analysis was conducted to analyze whether the rankings are dependent on the EDAS method. The same decision matrix and CRITIC weights were used to calculate rankings by the TOPSIS, the Simple Additive Weighting (SAW), and the VIKOR methods. Numerical results obtained from these different methods are shown in Table 11.

Table 11. Comparative Results Using CRITIC Weights

Alternatives	EDAS (AS)	R	TOPSIS (CC)	R	SAW (S)	R	VIKOR (Qi)	R
SketchUp	0.9877	1	0.9693	1	0.9794	1	0.3962	2
Rhinoceros	0.8490	2	0.9018	2	0.8807	2	0.2330	1
Fusion	0.6472	3	0.7586	3	0.8116	3	0.5907	4
Inventor	0.4212	4	0.5466	4	0.7704	4	0.6143	5
SOLIDWORKS	0.0528	5	0.0484	5	0.7501	5	0.5000	3

The results from the three additional methods (TOPSIS, SAW, and VIKOR) indicate that the rankings obtained through EDAS are, with the exception of the VIKOR method, supported by these alternative MCDM methods. VIKOR results in slightly different results, possibly due to its methodology. VIKOR evaluates both the overall

performance and the worst individual criteria score of each alternative, thus favoring alternatives with more balanced scores across all criteria. In this study, SketchUp's maximum regret value (Rj = 0.216) was higher than that of Rhinoceros (Rj = 0.190), which caused VIKOR to favor Rhinoceros (Opricovic and Tzeng 2004).

To assess the stability of the criteria weights and resulting ranking, three robustness checks were performed: equal weighting, objective weighting using the entropy method, and a variant excluding the cost criterion. For the entropy check, criteria weights were computed following the entropy procedure described by studies in Bayram (2020) and Çakmak and Bayram (2026). EDAS ranking was then recalculated with these weights. The entropy weights were obtained as w = (0.2494, 0.2280, 0.2232, 0.2446, 0.0548) for C1 to C5, respectively. Notably, although the entropy method assigned a much lower weight to cost (0.055) than CRITIC (0.302), the recalculated EDAS ranking was identical to the base ranking (SketchUp > Rhinoceros > Autodesk Fusion > Autodesk Inventor > SOLIDWORKS), as was the ranking under equal weights (Table 12). This suggests that the ranking comes from how the data are distributed, not from the particular weighting method used. When cost was left out of the analysis altogether, the order flipped (SOLIDWORKS > SketchUp > Autodesk Inventor > Autodesk Fusion > Rhinoceros): the software with the strongest user ratings but the highest price moved to the top. This confirms that cost is what really separates the alternatives, and that the ranking reported here reflects value for money under a limited budget.

Table 12. Ranking Stability under Alternative Weighting Scenarios

Scenario	SketchUp	Rhinoceros	Fusion	Inventor	SOLIDWORKS
CRITIC (base)	1	2	3	4	5
Equal weights	1	2	3	4	5
Entropy weights (Çakmak and Bayram 2026)	1	2	3	4	5
Excluding cost (C5)	2	5	4	3	1
* Values indicate the rank of each alternative under each scenario. The ranking is stable across all weighting scenarios; it changes only when the cost criterion is removed, confirming that cost is the decisive differentiator.					

In addition to the weighting-based robustness checks above, a total cost of ownership (TCO) scenario was examined, since the alternatives differ in their licensing models. The base analysis used first-year expenditure; to assess longer planning horizons, the subscription costs were extended over 3- and 5-year periods while the one-time perpetual license of Rhinoceros was held constant (SketchUp: $819/$2,457/$4,095; Autodesk Fusion: $1,752/$5,256/$8,760; SOLIDWORKS: $4,716/$14,148/$23,580; Rhinoceros: $1,162 across all horizons; Autodesk Inventor: $2,585/$7,755/$12,925 for 1/3/5 years, respectively). With this calculation, SketchUp stays in first place for the 1-year horizon, but over 3- and 5-years Rhinoceros moves to the top, since its one-time license gradually pays off against the recurring subscription fees of the others. So, the best option really depends on how far ahead the buyer is planning: SketchUp is the cheapest choice for short-term use, while Rhinoceros becomes the better deal in the long run.

Limitations

Limitations of this study include that the evaluation criteria used were limited by the criteria available on the Capterra and G2 platforms. Additional criteria (such as directly sector-related ones, render quality, Computer Numerical Control (CNC) suitability, and others) were not possible due to the nature of the data source. Additionally, these user reviews come from users in all industries, not only from the woodworking sector. Furthermore, the data were acquired in January 2026, and it may change over time. The results presented may change based on the criteria weights, methods, and priorities of decision-makers. For instance, VIKOR resulted in different rankings compared to EDAS, TOPSIS, and SAW. Or, if cost is not considered an issue, CAD software, such as SOLIDWORKS, may be the best alternative. The evaluation is also based on five alternatives, which is a relatively small sample for correlation-based weighting methods such as CRITIC. With a small sample, the inter-criteria correlation matrix can be sensitive to individual values. To mitigate this concern, multiple weighting approaches (CRITIC, entropy, and equal weights) were applied, all of which produced a consistent ranking. Nevertheless, the results should be interpreted with this sample-size limitation in mind. It should also be emphasized that while the candidate software was identified from woodworking- and furniture-oriented sources, the user ratings themselves originate from general proposed review platforms and are not filtered by industry. The resulting set of alternatives therefore represents the natural intersection of two conditions; visibility in woodworking and furniture-oriented sources and sufficient general popularity to provide a reliable volume of user reviews. The sector specific aspect of this study thus lies in the selection of alternatives rather than in the origin of rating data. Ratings filtered specifically of woodworking sector users would strengthen the sector relevance, but such filtering is not supported currently by the platforms.

A further consideration is that the model treats each aggregate rating equally, without weighting by the number of underlying reviews. In principle, a rating based on 2,360 reviews carries greater reliability than one based on 280 reviews. In this study, however, all included alternatives exceeded 280 reviews (SketchUp: 2,360; SOLIDWORKS: 1,376; Autodesk Fusion: 772; Autodesk Inventor: 713; Rhinoceros: 280), which represent statistically substantial samples well above the review-volume threshold discussed in the Experimental section. The difference in reliability among such large samples is therefore limited in practical terms. Building review counts directly into the ratings, for example by weighting each score by its number of reviews, or applying a Bayesian adjustment, would add extra assumptions to the model and bring back a degree of subjectivity, which is exactly what this framework tries to avoid. This is left as a useful direction for future work.

Another limitation that can be stated is that even though the five CAD software alternatives evaluated in this study may overlap in some use cases, they do not necessarily serve identical purposes. For instance, assuming that the SOLIDWORKS and Autodesk Inventor may be more commonly associated with mechanical and parametric design, while others may be more suited for architectural modeling. The MCDM framework employed here does not assume full interchangeability of alternatives. This framework offers a structured decision-support tool for organizations that need to select one software within a given budget and operational context. Therefore, decision-makers should consider their specific functional requirements before acting on the rankings presented.

Discussion

The CRITIC method revealed that the Cost criterion has the highest weight (w5 = 0.3024, Table 6), which is about double that of each other criterion. This is no surprise, as user input data has narrow numerical values (typically 1 to 5), while cost for the CAD software ranges from 819 to 4,716 USD. The Cost criterion showed a strong negative correlation with the Features (C3, −0.96, Table 5) and Customer Service (C4, −0.90) criteria, indicating that costly software tends to offer better features and customer service. For example, if different CAD software would get similar scores for Features (C3) and Customer Service (C4), the best choice would be the most affordable one. It should be acknowledged that the high weight assigned to the cost criterion (0.3024) is partly scale-driven effect rather than a reflection of intrinsic business importance. The four criteria (C1 to C4) are compressed within a narrow rating band (4.0 to 4.7), whereas licensing cost span much wider range (819 to 4,716 USD) After min -max normalization, this disparity increases the relative variance and information content of cost criterion, which the CRITIC method captures higher weight. Consequently, the resulting ranking is best interpreted as an affordability-oriented ranking under budget constraints rather than an absolute quality ranking.

SketchUp had the highest total score (AS = 0.9877, Table 9) because it has competitive user ratings for most criteria (*e.g.*, Customer Satisfaction (C1), Ease of Use (C2), Features (C3), and Customer Service (C4)) combined with an affordable price compared to the competition. For example, SketchUp acquired the highest score for Ease of Use (4.4, Table 3) tied with SOLIDWORKS. Indeed, SOLIDWORKS achieved the highest or tied-highest scores on user input data (Customer Satisfaction (C1, 4.6, Table 3), Ease of Use (C2, 4.4), Features (C3, 4.7), and Customer Service (C4, 4.2,). However, SOLIDWORKS ranked last (Table 9) due to its price (C5, 4,716 USD, Table 3), *e.g.*, about six times higher than SketchUp (C5, 819 USD). It is therefore important to note that SOLIDWORKS ranking last does not mean that it is technically weak. In fact, it earned the highest or joint-highest user ratings on most of the quality criteria. It falls to the bottom only because the evaluation works under a budget constraint, and its much higher licensing cost outweighs that quality advantage. For a company where budget is not the main concern, SOLIDWORKS would actually be the best choice. Rhinoceros ranked second (AS = 0.8490, Table 9), supported by a competitive cost (approximately 40% higher than SketchUp) and the highest customer satisfaction score (C1, 4.6, Table 3), tied with SOLIDWORKS.

This study differs from previous studies in several ways. First, SketchUp and Rhinoceros have not been evaluated in any of the previous CAD selection studies, which limits direct comparison. However, some observations can still be made. For example, SOLIDWORKS ranked third among four alternatives in Bataineh *et al.*'s (2018) study, while it ranked last in this study among five alternatives. The main reason behind this difference is the weight assigned to the cost criteria. Bataineh *et al.* (2018) used AHP methodology and found Features to have the highest weight (0.419), whereas in this study, the CRITIC method assigned the highest weight to Cost (0.302). The high weight of the cost criteria is the main reason for SOLIDWORKS ranking last. In a similar finding, Zakria *et al.* (2010) also identified Cost as the second most important criterion. Additionally, none of the previous studies focused on the woodworking sector.

The above-mentioned studies (Kannan and Vinay 2008; Ayağ 2010; Zakria *et al.* 2010; Bataineh *et al.* 2018; Simanavičienė and Vdovinskienė 2023) were all conducted using AHP methodology based on expert judgments. In their approach, subjective pairwise

comparisons by several experts determine the data and, consequently, the results. In this study, however, criteria weights were derived from the statistical properties of the decision matrix using the CRITIC method, without expert intervention. The input data were based on thousands of user reviews. This approach has the advantages of being reproducible and low cost: the same data can be collected from the same platforms to obtain the same results. However, a disadvantage is that user reviews are not sector-specific, and the evaluation criteria are limited to those available on the platforms. In general, it cannot be said that one method is more powerful than the other. Expert-based methods can provide inputs by considering sector-specific insights and criteria that are not available on review platforms. In contrast, review-based input provides a general outlook from numerous users. A hybrid methodology combining expert judgment and review data could be considered in future studies, benefiting from the advantages of both approaches. In a comparative analysis, the EDAS, TOPSIS, and SAW methods produced the same rankings. However, VIKOR provided a different result by placing Rhinoceros first and SketchUp second. The VIKOR, unlike EDAS, TOPSIS, and SAW, explicitly incorporates the maximum individual regret (Rj) of each alternative, which represents the largest weighted gap on any single criterion. In this study, SketchUp's maximum regret value (Rj = 0.216) was higher than that of Rhinoceros (Rj = 0.190), meaning SketchUp had a larger weighted gap on its weakest criterion (Customer Satisfaction, C1). This caused VIKOR to favor Rhinoceros, which had a more balanced performance across all criteria (Opricovic and Tzeng 2004).

The results show that all five CAD software alternatives received closely rated user scores (ranging between 4.0 and 4.7). This indicates that all alternatives have been positively reviewed by users. Therefore, the critical criterion that mainly differentiates the alternatives is Cost, which ranges from 819 USD to 4,716 USD. For budget-restricted firms, SketchUp appears to be the optimal alternative, with competitive user ratings and the most affordable licensing cost. Rhinoceros is also a strong alternative with a competitive cost. If budget were not a constraint, SOLIDWORKS would be the best alternative, with the highest scores in almost all criteria. Accordingly, the resulting ranking should be understood as an affordability-oriented ranking under budget constraints, rather than an absolute measure of software quality or suitability.

This study enables comparisons among alternatives without the need for input of expert judgment. Criteria weights were calculated objectively using the CRITIC method, and the required data were obtained through numerous user reviews on relevant platforms. Results can be obtained without including expert input. Fourteen sources were analyzed to identify commonly used CAD software in the woodworking sector. However, review platforms, namely Capterra and G2, include reviews from all industries, not limited to sector-specific ones. This is a limitation, and if platforms provide sector-specific filtering options in the future, more targeted evaluations can be made. Additionally, this study promotes the CRITIC-EDAS method instead of the commonly used AHP methodology. The results were supported by other methods such as TOPSIS and SAW. This provides an alternative methodology for CAD selection in the relevant literature.

Furthermore, the rankings presented here were not validated against real-world purchasing decisions. A case-study validation would require accounting for firm-specific strategic priorities and budget conditions, which vary considerably across organizations and could lead to the evaluation of a different set of software alternatives. Since the primary aim of this study is to propose a reproducible evaluation framework rather than to prescribe a universal choice, such validation is left to future work. Future studies could also involve the research team directly operating and testing the candidate software on a common set of

representative design tasks, enabling a hands-on, performance-based comparison; such an approach would complement the review-based evaluation presented here and would not need to be limited to software with a large volume of published user reviews.

CONCLUSIONS

1. SketchUp ranked first (AS = 0.9877), followed by Rhinoceros (AS = 0.8490), Autodesk Fusion (AS = 0.6472), Autodesk Inventor (AS = 0.4212), and SOLIDWORKS (AS = 0.0528).
2. All alternatives received relatively similar user scores (4.0 to 4.7); the main discriminator was the cost criterion, which received the highest CRITIC weight (w = 0.3024), reflecting the wide price range among alternatives compared to the narrow spread in user ratings. Even though SOLIDWORKS achieved the highest user scores for most criteria, its higher licensing cost ($4,716/year) for the selected plan made its ranking last. The most cost-effective alternative also depends on the planning horizon: SketchUp is preferable for short-term use, while Rhinoceros becomes more economical over longer horizons due to its one-time perpetual license.
3. This study emphasizes that the publicly available user review data (in this case, from the Capterra and G2 platforms) can be used as input for MCDM methods instead of expert judgments, providing a reproducible and low-cost alternative to expert-based approaches, especially for small and medium-sized enterprises (SMEs) that may lack access to relevant experts and have limited resources.
4. This study presents the first application of the CRITIC-EDAS framework, based on publicly available user review data, to CAD software popular in the woodworking sector, addressing three gaps in the literature: user review data were utilized instead of expert judgments; the woodworking sector was targeted; and the CRITIC-EDAS framework was applied instead of the commonly used AHP methodology. However, filtering sector-specific reviews was not possible, which remains a limitation of this study.

ACKNOWLEDGMENTS

The author thanks Dr. Urs Buehlmann, Virginia Tech, for his thorough review and valuable feedback on this manuscript.

Conflict of Interest

The author reports no potential conflict of interest.

Use of Generative AI

During the preparation of this manuscript, the author used Claude Sonnet 4.6 and Claude Opus 4.6 (Anthropic), and Grammarly v1.2.267.1898 for writing and grammar checking, as well as for improving the clarity and readability of selected sentences. These tools were used only for language-related support. The author reviewed and edited all AI-assisted outputs and takes full responsibility for the content of the manuscript.

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Article submitted: July 14, 2026; Peer review completed: August 8, 2026; Revised version received: September 4, 2026; Published: November 12, 2026.
DOI: 10.15376/biores.22.1.275-296

APPENDIX

Table A1. Web Sources/URLs for Software Reviews and Comparison Guides

Code	Source
W1	WoodDesigner.org (2026). "Woodworking design software comparison: What the pros use," Wood Designer, Retrieved January 12, 2026, from https://wooddesigner.org/woodworking-design-software-comparison/.
W2	TrustMySoftware.com (2025). "Top 9 Best CAD Software for Woodworking in 2025," Trust My Software, Retrieved January 12, 2026, from https://trustmysoftware.com/blog/best-cad-software-for-woodworking/.
W3	Makers Manual (2026). "Best CAD Software for Woodworking," Makers Manual, Retrieved January 12, 2026, from https://makers-manual.com/best-cad-software-woodworking.
W4	CGI Furniture (2026). "Best 3D Modeling Software for Furniture in 2026," CGI Furniture, Retrieved January 12, 2026, from https://cgifurniture.com/blog/3d-modeling-software-for-furniture/.
W5	CadCrowd (2026). "Top 10 Furniture Design Software Used by 3D Modeling Freelancers and Product Design Firms," CadCrowd, Retrieved January 12, 2026, from https://www.cadcrowd.com/blog/top-10-furniture-design-software-used-by-3d-modeling-freelancers-and-product-design-firms/.
W6	Shapr3D (2026). "9 furniture design software to try in 2026," Shapr3D, Retrieved January 12, 2026, from https://www.shapr3d.com/content-library/furniture-design-software.
W7	KTY (2026). "Mobilya Sektöründe Hangi Yazılımlar Kullanılıyor [Which software is used in the furniture sector]," KTY, Retrieved January 12, 2026, from https://kty.com.tr/mobilya-sektorunde-hangi-yazilimlar-kullaniliyor/.
W8	Mobilya Yaptırma [Furniture Making] (2026). "En İyi Mobilya Tasarım Programları: Profesyoneller İçin Rehber [The best furniture design programs: A guide for professionals]," Mobilya Yaptırma, Retrieved January 12, 2026, from https://mobilya.yaptirma.com.tr/en-iyi-mobilya-tasarim-programlari-profesyoneller-icin-rehber/.
W9	Renderedge Studio. (2026). "The Top 10 Furniture Designing Software," Renderedge Studio Retrieved January 12, 2026, from https://renderedgestudio.com/the-top-10-furniture-designing-software/.
W10	ElogicTech. (2026). "Top 5 CAD Software for Furniture Modeling," ElogicTech, Retrieved January 12, 2026, from https://www.elogictech.com/blog/top-5-cad-software-for-furniture-modeling/.
W11	NBYIT. (2026). "Best 3D Modeling Software For Furniture," NBYIT, Retrieved January 12, 2026, from https://nbyit.com/best-3d-modeling-software/.
W12	Sinclair Cabinets. (2025). "7 Cabinet Design Software Reviews [2025 Update]," Sinclair Cabinets, Retrieved January 12, 2026, from https://sinclaircabinets.com/cabinet-design-software-reviews/.
W13	Professional 3D Services. (2026). "List of 12 Best Paid and Free 3D Furniture Design Software," Professional 3D Services, Retrieved January 12, 2026, from https://professional3dservices.com/blog/furniture-design-software.html.
W14	TechJockey. (2026). "Top 12 Free & Paid Furniture Design Software for Beginners & Pros in 2026," TechJockey, Retrieved January 12, 2026, from https://www.techjockey.com/blog/best-furniture-design-software.

Table A2. Product profile pages from which rating data were retrieved (accessed 12 January 2026)

Software	Capterra product page
SketchUp	https://www.capterra.com/p/211798/SketchUp/
Autodesk Fusion	https://www.capterra.com/p/178416/Fusion-360/
SOLIDWORKS	https://www.capterra.com/p/93121/SolidWorks-Premium/
Rhinoceros	https://www.capterra.com/p/58468/Jewelry-Modeling/
Autodesk Inventor	https://www.capterra.com/p/236745/Inventor/
SketchList 3D	https://www.capterra.com/p/204375/SketchList-3D/
Note: URLs are given as they appear on Capterra; the Rhinoceros listing carries a legacy URL slug.	