

Enhancing User Experience on Journal Websites: A Novel Entropy-based Weighing Method with MARCOS and COCOSO Ranking Approaches

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This paper addresses the dearth of research dedicated to optimizing UI designs of journal websites by proposing a novel evaluation framework. Drawing upon insights from existing literature, methodologies from manufacturing layout optimization, and MCDM techniques, a comprehensive approach was introduced to assess and enhance journal website UI designs. The methodology integrates the MARCOS and COCOSO systems with entropy-based weighing to provide a thorough evaluation of UI designs, considering both qualitative and quantitative factors. Through a systematic analysis of UI design criteria, such as content accessibility, readability, search functionality, and visual design, the framework aims to identify strengths and weaknesses in journal website interfaces. The results from evaluation demonstrate the critical importance of factors such as content accessibility and readability, alongside search functionality and user-friendly navigation. By leveraging MCDM techniques, improvements that enhance user satisfaction and engagement levels are prioritized. Alternative A2 is found best followed by A1, A5, A4, and A3. Furthermore, sensitivity analysis ensures the robustness/reliability of the framework, allowing for an examination of the impact of varying weights on evaluation outcomes. Overall, the study contributes to bridging the gap between existing research on UI design principles and the specific challenges faced by journal website interfaces. Based on the individual factor weights, developers may focus to improve existing designs as per the ranking of the factors. This holistic approach provides valuable insights for journal website managers seeking to optimize UI designs and improve user experiences.

Keywords: Scholarly communication, Sensitivity analysis, User experience, Visual design, Website evaluation

Introduction

The importance of good UI design cannot be overstated in today's digital landscape. A well-crafted user interface serves as the gateway between users and digital products or services, significantly influencing their overall experience and interaction.¹ A good UI design not only enhances the aesthetic appeal of a platform but also plays a crucial role in facilitating intuitive navigation and seamless interaction.² It ensures that users can easily access the features and information they need, leading to increased satisfaction and engagement. Moreover, a thoughtfully designed UI can contribute to improved usability, efficiency, and accessibility, making digital experiences more inclusive and enjoyable for a diverse range of users.³ Ultimately, investing in good UI design is essential for building trust, fostering brand loyalty, and achieving success in an increasingly competitive digital landscape.

In today's digital landscape, the user interface (UI) of journal websites plays a critical role in enhancing the overall user experience and ensuring efficient retrieval of information. With scholarly publications moving towards online platforms at an accelerating pace, the design and functionality of journal websites have become central to their success in drawing in readers and encouraging active engagement. As more and more scholarly content migrates to digital spaces, users rely heavily on the UI of journal websites to navigate through vast repositories of academic knowledge. A well-designed UI not only facilitates seamless access to relevant information but also enhances the browsing experience, making it more intuitive and enjoyable for users to interact with scholarly content.⁴

Moreover, the digital transformation of scholarly publishing has reshaped the way readers consume academic literature. With online platforms offering increased accessibility and convenience.⁵ Users expect journal websites to provide not only easy access to content but also features that enhance their

overall experience, such as advanced search capabilities, personalized recommendations, and interactive elements. Therefore, in this digital era, the UI design of journal websites holds immense significance as it directly impacts user satisfaction, engagement, and the effectiveness of information retrieval processes. As such, ensuring an intuitive, visually appealing, and functional UI has become paramount for scholarly publishers seeking to maintain relevance and attract a diverse readership in an increasingly competitive online environment.

Traditional approaches to assessing UI designs frequently depend on subjective judgments or basic metrics, which may fail to capture essential aspects influencing user satisfaction and usability.⁶ To address this deficiency, the study introduces a pioneering framework that combines the Measurement of Alternatives and Ranking according to Compromise Solution (MARCOS) and Combined Compromise Solution ranking (COCOSO) systems, along with an entropy-based weighing technique. By merging these methodologies, the objective is to provide a thorough and unbiased evaluation of journal website UI designs, considering both qualitative and quantitative factors.

The MARCOS and COCOSO systems offer structured methods for evaluating alternatives and ranking solutions, particularly beneficial in the assessment of digital resources like journal websites. Incorporating these systems into the framework allows for a systematic analysis of various aspects of UI design, such as navigational ease, visual appeal, and content organization. Additionally, the utilization of an entropy-based weighing method enables us to assign appropriate weights to different evaluation criteria based on their significance in influencing overall UI performance.⁷ This approach not only enhances the precision of the assessments but also ensures a comprehensive understanding of the strengths and weaknesses of each UI design under scrutiny. By integrating these approaches, the framework aims to provide a holistic assessment of journal website UI designs, capturing both the qualitative aspects that enhance user experience and the quantitative metrics that measure usability. This comprehensive evaluation methodology is essential for guiding improvements in UI design, ultimately leading to enhanced user satisfaction and engagement with scholarly content.

Literature review

In the expansive realm of user interface (UI) design, where digital experiences wield substantial influence over user satisfaction and engagement, the domain of journal website UI design stands as a unique yet overlooked niche. Despite the proliferation of research aimed at refining UIs across diverse digital platforms, a noticeable gap persists in addressing the specific requirements and challenges inherent to journal websites. These platforms serve as pivotal gateways for researchers and users alike, facilitating swift access to scholarly content amidst a vast sea of information. However, the absence of tailored research endeavours focusing on optimizing the UI design of journal websites represents a significant lacuna in the scholarly landscape. This absence is particularly striking when juxtaposed against the abundant research devoted to optimizing layout designs in manufacturing industries using sophisticated Multi-Criteria Decision-Making (MCDM) techniques. While these methodologies have been rigorously applied to streamline processes and enhance usability in manufacturing contexts, their potential application to UI layout optimization, particularly within the nuanced realm of journal websites, remains largely untapped.

It is indicated that⁸ enhancing information quality and communication effectiveness has been the primary focus in improving websites. In the research conducted by Vasishta (2013), it was found that the library websites of technical university libraries in North India are in a rudimentary stage, lacking advanced features and falling short of their potential to effectively disseminate electronic journals. The study suggests significant room for improvement in various aspects, including the quality of content, user convenience, and design aesthetics, to enhance the effectiveness of these websites as platforms for information dissemination.⁹ The study proposes a strategic framework for website evaluation, synthesizing literature from 1995 to 2006. It aims to provide a comprehensive approach to assessing website effectiveness and guiding future research in this area.¹⁰ Online travel websites are vital for travelers, and their effectiveness is crucial for managers. Chiou *et al.* (2011)¹¹ proposed a strategic evaluation framework to assess alignment with objectives. Two leading online travel agencies are analyzed, revealing strategy inconsistencies through gap analysis and radar chart analysis of 4PsC

dimensions. According to Rocha (2012)¹², website quality can be classified into three main dimensions: content quality, service quality, and technical quality. Despite this categorization, there is a lack of comprehensive evaluation methodologies that encompass all three dimensions in a broad and cross-cutting manner. Many government websites lack consistency in assessing quality due to varied questionnaires. Elling *et al.* (2007)¹³ also proposed a generic Website Evaluation Questionnaire (WEQ) based on usability and user satisfaction literature, providing a reliable tool for assessing and benchmarking informational websites. The journal websites, serving as digital repositories for scholarly knowledge, hold paramount importance in the dissemination and accessibility of academic research. In today's digital age, where the majority of scholarly publications are transitioning to online platforms, the design and functionality of journal websites play a pivotal role in shaping user experiences and influencing engagement levels. A well-crafted UI not only facilitates seamless navigation but also enhances the overall browsing experience, making it more intuitive and rewarding for users to interact with scholarly content. Moreover, the digital transformation of scholarly publishing has revolutionized the way users engage with academic literature, necessitating UI designs that prioritize accessibility, efficiency, and user-centricity.

Despite the critical role played by journal websites in the scholarly ecosystem, research efforts dedicated to optimizing their UI designs remain disproportionately scarce. While numerous studies have delved into UI design principles and methodologies across various digital domains, the specific intricacies and challenges associated with journal website UI design have received scant

attention. This gap in research represents a missed opportunity to enhance the usability, efficiency, and user satisfaction levels of these crucial platforms.

In contrast to the few research¹⁴ focusing on website UI evaluation using MCDM approach, a wealth of literature exists exploring layout optimization in manufacturing industries using advanced MCDM techniques. These methodologies, ranging from Analytic Hierarchy Process (AHP) to Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), have been extensively employed to improve operational efficiency, resource allocation, and decision-making processes in manufacturing settings. By prioritizing criteria such as cost-effectiveness, resource utilization, and production efficiency, researchers and practitioners have successfully optimized layout designs to enhance overall performance and competitiveness within the manufacturing sector. The data in Table 1 shows the previous studies done in layout selection using MCDM techniques.

Study by Wu *et al.*²⁴ presents the Design Entropy Model (DEM) to assess information overload in universal smart TV remote controls. By measuring Appearance Design Entropy (ADE) and Interaction Design Entropy (IDE), the study confirms a significant correlation between design entropy and user experience. Mukhametzyanov²⁵ compares methods for determining criteria weights, advising against formal approaches like Entropy, CRITIC, and Standard Deviation due to their sensitivity. Another study²⁶ investigates selecting the best mobile phone from a user perspective, focusing on usability as a key factor. It employs the AHP for weight estimation and entropy method to verify results, offering insights for users by ranking alternatives based on usability factors. This AHP-Entropy model is applied to a case

Table 1 — Previous studies focusing on facility layout selection using MCDM techniques

Paper Title	MCDM Techniques used
The evaluation of appropriate office layout design with MCDM techniques ¹⁵	AHP, ELECTRE, and permutation methods.
A Hybrid MCDM Method Using Combination Weight for the Selection of Facility Layout in the Manufacturing System: A Case Study ¹⁶	Delphi, fuzzy ANP, Entropy, and fuzzy PROMETHEE
A Hybrid MCDM Approach Based on ANP and TOPSIS for Facility Layout Selection ¹⁷	ANP and TOPSIS
MCDM Model for Evaluating and Selecting the Optimal Facility Layout Design: A Case Study on Railcar Manufacturing ¹⁸	Fuzzy AHP and Fuzzy-TOPSIS
Analysis of facility layout using MCDM approach: a case study of a manufacturing industry ¹⁹	AHP
Combination of MCDM and covering techniques in a hierarchical model for facility location: A case study ²⁰	TOPSIS
Facility layout selection using PROMETHEE II method ²¹	PROMETHEE-II
A TOPSIS-based approach for sustainable layout design: activity relation chart evaluation ²²	TOPSIS, Activity relationship chart
A novel hybrid MCDM model combining the SAW, TOPSIS and GRA methods based on experimental design ²³	SAW, TOPSIS and GRA

study on mobile phone usability evaluation, aiding informed decision-making. The study by Punita & Jain²⁷ presents a novel approach using Multi-criteria Decision-Making (MCDM) techniques for product recommendation, integrating online ratings and user preferences efficiently. It utilizes feature-specific rating information, Shannon entropy for criteria weight determination, and complex proportional assessment for ranking alternatives, yielding reliable results. Based on the above studies, entropy method is found to be effective method for deciding weights.

The COCOSO method, which stands for Combined Criteria and Simple Additive Weighting, is a multi-criterion decision-making (MCDM) approach that integrates the principles of both the simple additive weighting method and the exponentially weighted product model. Various studies involved COCOSO approach in the research for supplier selection²⁸, for location selection^{29,30}, for supplier selection³¹, for evaluation of healthcare sectors³², for circular economy³³ in urban mobility alternatives.

The study based on MARCOS method³⁴ delves into the importance of investment management for organizational growth, emphasizing the application of project management techniques. It evaluates four project management software programs in the United Arab Emirates, utilizing the MARCOS method. Another study³⁵ applied MARCOS to four engineering problems. Comparative analysis with other MCDM methods and rank reversal tests demonstrate the robustness and applicability of the MARCOS method across diverse engineering applications.

Contribution of this Study

The novel contribution of this paper lies in bridging the gap between the rich literature on layout optimization in manufacturing industries and the nascent field of journal website UI design. By applying MCDM techniques to evaluate and optimize UI layouts, this research endeavours to address the pressing need for tailored solutions within this underexplored domain. Through a systematic analysis of UI design criteria, such as navigational clarity, visual hierarchy, and content organization, aim to develop a comprehensive framework for optimizing journal website interfaces.

Moreover, by integrating entropy-based weighing methods into the framework, author seek to enhance the accuracy and objectivity of UI design evaluations. By assigning appropriate weights to different

evaluation criteria based on their significance and impact on overall UI performance, author can ensure a more nuanced and comprehensive assessment of journal website interfaces. This approach not only facilitates data-driven decision-making but also enables us to identify and prioritize areas for improvement within UI designs, ultimately enhancing user satisfaction and engagement levels.

Materials and Methods

Factor Identification (Stage 1)

The materials and methods utilized in this research (Fig. 1) entailed a rigorous process commencing with an extensive investigation into the multifaceted factors that influence User Experience (UX) in the realm of journal website UI design. This endeavour involved a thorough literature review, examination of user feedback and reviews, as well as interviews with experts in UX design, human-computer interaction, and scholarly publishing, alongside the distribution of surveys among diverse journal website users. Through this comprehensive approach, a comprehensive list of factors was compiled, which underwent meticulous scrutiny to remove duplicates and subsequently underwent a stringent shortlisting process based on criteria such as perceived impact, relative significance, and feasibility of measurement. From this refined pool, a final selection of significant factors was determined, encompassing elements such as navigation ease, visual aesthetics, content organization, responsiveness, and accessibility. These factors served as the cornerstone for the subsequent weight estimation.

Entropy Method (Stage 2)

The entropy method involves several steps to determine the relative importance of each factor in a given dataset. Firstly, a decision matrix is constructed, where rows represent the different alternatives or options being evaluated (e.g., different factors influencing UX in journal website UI design), and columns represent the criteria or attributes under consideration (e.g., navigation ease, visual aesthetics, etc.). Each cell in the matrix contains numerical scores representing the performance of each alternative on each criterion. Next, normalization is performed to ensure that all criteria are measured on the same scale. This typically involves transforming the raw scores into standardized values, such as percentages or scores between 0 and 1. Following normalization, the Shannon entropy of each criterion is calculated to

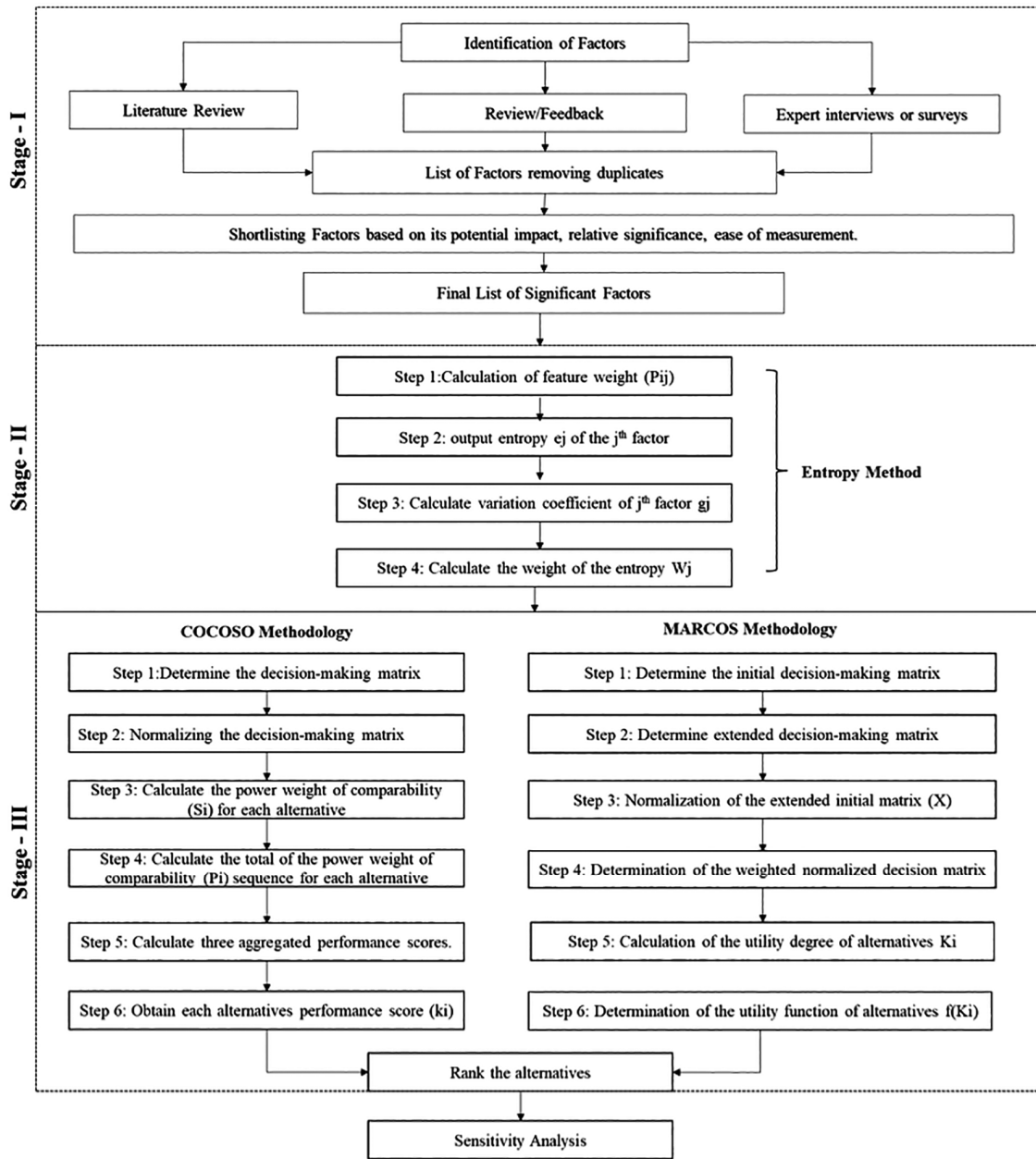


Fig. 1 — Research methodology

quantify the uncertainty or variability present in the dataset. The entropy value reflects the diversity of scores across alternatives for each criterion, with higher entropy indicating greater diversity. Subsequently, the weights for each criterion are derived by calculating the entropy reduction ratio, which compares the entropy of each criterion to the total entropy of the dataset. The weight of each criterion is inversely proportional to its entropy value, with lower entropy indicating higher importance and thus a higher weight. Finally, the calculated weights are normalized to ensure they sum up

to 1, providing a meaningful representation of the relative importance of each criterion in the decision-making process. This method allows for a systematic and objective assessment of criteria weights based on the information entropy present in the dataset, facilitating informed decision-making and prioritization of factors in complex systems like journal website UI design.

Step 1: Calculation of feature weight (P_{ij}) for the i^{th} alternative (m) and j^{th} criterion(n), a_{ij} is cell value of decision matrix.

$$P_{ij} = \frac{a_{ij}}{\sum_{i=1}^m a_{ij}^2}, (1 \leq i \leq m, 1 \leq j \leq n, 1 \leq a \leq \infty) \quad \dots (1)$$

Step 2: The output entropy (e_j) of the j^{th} factor

$$e_j = -k \sum_{i=1}^m (P_{ij} \ln P_{ij}), (1 \leq j \leq n) (0 \leq e_j \leq 1)$$

and $k = 1/\ln(m)$... (2)

Step 3: Calculation of variation coefficient (g_j) of j^{th} factor

$$g_j = |1 - e_j|, (1 \leq j \leq n) (0 \leq g_j \leq 1) \quad \dots (3)$$

Step 4: Calculation of weight of the entropy (w_j).

$$w_j = \frac{g_j}{\sum_{i=1}^m g_j} (0 \leq w_j \leq 1) \quad \dots (4)$$

COCOSO Methodology (Stage 3)

In this research, the COCOSO method is employed as a robust framework to ascertain the ranking of health insurance service providers. The COCOSO model, designed for scenarios with a multitude of alternatives (m) and criteria(n), encompasses five fundamental steps. These steps encompass the entire decision-making process, from the formulation of the decision problem to the computation of the final rankings. By leveraging the COCOSO approach, the research aims to provide valuable insights and recommendations for selecting best insurance policy/service provider. The method's ability to incorporate various criteria and combine them into a unified ranking enables a thorough and reliable assessment of the alternatives. Through its step-by-step execution, the COCOSO method ensures a rigorous and comprehensive evaluation process that ultimately leads to more robust decision outcomes.

Step 1: It involves determining the decision-making matrix X , denoted as $X = (x_{ij})$, with dimensions' $m \times n$, where x_{ij} represents the value associated with the i^{th} alternative and the j^{th} criterion.

$$x_{ij} = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad \dots (5)$$

Step 2: Normalizing the decision-making matrix using Eq. 6 and Eq. 7 where r_{ij} is normalized value of initial decision matrix x_{ij} .

For beneficial criterion:

$$r_{ij} = \frac{\max(x_{ij}) - x_{ij}}{\max(x_{ij}) - \min(x_{ij})} (0 \leq r_{ij} \leq 1) \quad \dots (6)$$

For non-beneficial criterion:

$$r_{ij} = \frac{x_{ij} - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})} (0 \leq r_{ij} \leq 1) \quad \dots (7)$$

In Step 3, the calculation of the power weight of comparability (S_i) and the total power weight of comparability (P_i) sequence for each alternative is performed using Eqs 8 and 9 respectively.

$$S_i = \sum_{j=1}^n (w_j r_{ij}) \quad \dots (8)$$

$$P_i = \sum_{j=1}^n (r_{ij}^{w_j}) (0 \leq S_i, P_i \leq \infty) \quad \dots (9)$$

Step 4: Calculate three aggregated performance scores. With k_{ia} as the relative performance scores of the i^{th} alternative calculated as the arithmetic mean of sums of S_i and P_i scores using Eq. 10:

$$k_{ia} = \frac{P_i + S_i}{\sum_{i=1}^m (P_i + S_i)} \quad \dots (10)$$

k_{ib} is the relative performance scores of the i^{th} alternative calculated as the sum of relative scores of S_i and P_i scores in comparison to the ideal performance values using Eq. 11.

$$k_{ib} = \frac{S_i}{\min S_i} + \frac{P_i}{\min P_i} \quad \dots (11)$$

k_{ic} is the relative performance scores of the i^{th} alternative calculated as the compromise of S_i and P_i performance scores. In Eq. 12, the λ value is selected by the decision makers and has a value between 0 and 1 (usually $\lambda = 0.5$).

$$k_{ic} = \frac{\lambda(S_i) + (1-\lambda)P_i}{\lambda \max S_i + (1-\lambda) \max P_i} \quad \dots (12)$$

Step 5: Obtain each alternative's performance score (k_i) using Eq. 13:

$$k_i = (k_{ia} k_{ib} k_{ic})^{\frac{1}{3}} + \frac{1}{3} (k_{ia} + k_{ib} + k_{ic}) \quad \dots (13)$$

$(0 \leq k_{ia}, k_{ib}, k_{ic}, k_i \leq \infty)$

The final ranking of the alternatives is based on the calculated performance scores with the optimal alternative having the highest score.

MARCOS Method (Stage 3)

MARCOS presents an innovative approach that finds use in various contexts. This method is crafted by incorporating both ideal and anti-ideal solutions. Subsequently, it evaluates the usefulness of different options and computes diverse utility functions using their utility values. This ultimately leads to the determination of alternative priorities and their subsequent ranking. The steps involved for ranking of alternatives in MARCOS method³⁶ provided by Stević *et al.* are as follows:

Step 1: Formation of initial and extended decision matrix. The initial decision matrix consists of ‘m’ criteria against ‘n’ number of alternatives. When dealing with group decision-making scenarios, matrices containing evaluations from experts are combined to form an initial matrix for group decision-making. For obtaining extended decision matrix(X), simply Anti-ideal solution (AAI) and Ideal solution (AI) are identified for all the criteria as per Eq. 14. The AAI represents the least favourable option, whereas the AI is an alternative distinguished by its superior characteristics based on type of criteria.

$$\begin{matrix}
 AAI & C_1 & C_2 & \dots & C_n \\
 A_1 & x_{aa1} & x_{aa2} & \dots & x_{aan} \\
 A_2 & x_{11} & x_{12} & \dots & x_{1n} \\
 A_2 & x_{21} & x_{22} & \dots & x_{2n} \\
 \dots & \dots & \dots & \dots & \dots \\
 A_m & x_{m1} & x_{22} & \dots & x_{mn} \\
 AI & x_{ai1} & x_{ai2} & \dots & x_{ain}
 \end{matrix} \quad \dots (14)$$

Step 2: Normalization. The normalized decision matrix is calculated using Eq. 15:

$$\begin{aligned}
 n_{ij} &= \frac{x_{ai}}{x_{ij}} \text{ if } j \in C, \text{ for } C = \text{Cost criteria} \\
 n_{ij} &= \frac{x_{ij}}{x_{ai}} \text{ if } j \in B, \text{ for } B = \text{Benefit criteria} \quad \dots (15)
 \end{aligned}$$

where, elements x_{ij} and x_{ai} represent the elements of the matrix X.

Step 3: Weighted Matrix (v). It is calculated using Eq. 16 where, w_j is the weight of criteria.

$$v_{ij} = n_{ij} \times w_j \quad \dots (16)$$

Step 4: Utility Degree (K). Utility degrees are calculated using Eq. 17 and Eq. 18 for all the alternatives based on the ideal and anti-ideal solution values as follows:

$$S_i = \sum_{i=1}^n v_{ij} \quad \dots (17)$$

$$K_i^+ = \frac{S_i}{S_{ai}} K_i^- = \frac{S_i}{S_{aai}} \quad \dots (18)$$

Step 5: Utility function. Different utility positive (K_i^+) and negative functions (K_i^-) are calculated based on the utility values using Eq. 19 and Eq. 20. However, the utility function is calculated based on the utility values and functions as follows:

$$f(K_i) = \frac{K_i^+ + K_i^-}{1 + \frac{1-f(K_i^+)}{f(K_i^+)} + \frac{1-f(K_i^-)}{f(K_i^-)}} \quad \dots (19)$$

$$\begin{aligned}
 f(K_i^-) &= \frac{K_i^+}{K_i^+ + K_i^-} \quad f(K_i^+) = \frac{K_i^-}{K_i^+ + K_i^-} \\
 &\dots (20)
 \end{aligned}$$

Step 6: Ranking. The alternative ranking is derived from the utility function values obtained in previous step.

Results and Discussion

In evaluation of journal website UI designs utilizing the hybrid COCOSO and MARCOS framework with entropy-based weighing, author considered several critical factors: Content Accessibility (C1), Readability and Clarity (C2), Search Functionality (C3), Visual Design (C4), Mobile Responsiveness (C5), User-Friendly Navigation (C6), Performance and Loading Speed (C7), and Feedback Mechanisms (C8) as shown in Table 2. The information presented in Table 3 was collected via a questionnaire-based survey. Respondents were tasked with assessing five alternatives across eight criteria using a rating scale ranging from 1 (poor) to 5 (excellent). A total of

Table 2 — Details of factors identified

Factor	Description
Content Accessibility ³⁷ (C1)	Ensure all users can access and understand content by adhering to accessibility standards and providing alternatives for non-text content.
Readability and Clarity (C2) ³⁸	Present information clearly and legibly with appropriate fonts, sizes, and contrast for easy comprehension.
Search Functionality (C3) ³⁹	Facilitate quick and accurate information retrieval through intuitive search features and relevant search results.
Visual Design (C4) ⁴⁰	Create an aesthetically pleasing interface aligned with brand identity, maintaining consistency and guiding user attention effectively.
Mobile Responsiveness (C5) ⁴¹	Optimize the interface for various screen sizes and touch interactions to ensure seamless usability on mobile devices.
User-Friendly Navigation (C6) ⁴²	Enable intuitive movement between sections with clear navigation menus, labels, and organizational structure.
Performance and Loading Speed (C7) ⁴³	Optimize code and assets to minimize loading times, ensuring swift interface response and content delivery.
Feedback Mechanisms (C8) ⁴⁴	Provide timely and informative feedback for user actions, errors, and progress to enhance user guidance and interaction satisfaction.

Table 3 — Criteria/Alternative Data and type

Type	Max	Max	Max	Max	Max	Max	Max	Max
Criteria	C1	C2	C3	C4	C5	C6	C7	C8
A1	4.2	4.3	4.8	4.7	4.5	4.9	4.8	4.5
A2	4.8	4.7	4.5	4.4	4.9	4.5	4.4	4.7
A3	3.5	3.8	4	4.2	4.1	4.2	4.2	4.2
A4	4.1	5	4.2	4.3	4.2	4.3	4.3	4.3
A5	4.3	4.2	4.6	4.8	4.4	4.9	4.9	4.5

Table 4 — Normalized decision matrix and calculation of weights

	C1	C2	C3	C4	C5	C6	C7	C8
A1	0.2010	0.1955	0.2172	0.2098	0.2036	0.2149	0.2124	0.2027
A2	0.2297	0.2136	0.2036	0.1964	0.2217	0.1974	0.1947	0.2117
A3	0.1675	0.1727	0.1810	0.1875	0.1855	0.1842	0.1858	0.1892
A4	0.1962	0.2273	0.1900	0.1920	0.1900	0.1886	0.1903	0.1937
A5	0.2057	0.1909	0.2081	0.2143	0.1991	0.2149	0.2168	0.2027
e_j	0.9969	0.9972	0.9987	0.9992	0.9988	0.9987	0.9988	0.9995
g_j	0.0031	0.0028	0.0013	0.0008	0.0012	0.0013	0.0012	0.0005
W_j	0.2563	0.2269	0.1072	0.0679	0.1002	0.1059	0.0964	0.0393

785 responses were meticulously gathered and organized. The respondents were 63% Male, 35% Female and 2% preferred not to mention. The average experience of respondents was more than 10 years. The responses collected were from different countries.

The criteria weight estimation was carried out using entropy method. The normalized decision matrix and calculation of weights is shown in Table 4. The estimated weights assigned to each factor were as follows: C1 – 0.2563, C2 – 0.2269, C3 – 0.1072, C4 – 0.0679, C5 – 0.1002, C6 – 0.1059, C7 – 0.0964, and C8 – 0.0393.

Content Accessibility (C1) stands out as the foremost factor in the evaluation, as evidenced by its highest weight of 0.2563. This weight reflects the paramount importance of ensuring that journal websites offer seamless access to their content. Accessibility encompasses various aspects, including the organization of information, clarity of labelling, and ease of navigation. A website with high accessibility ensures that users can quickly and intuitively find the content they seek, without encountering obstacles or confusion. Clear organization ensures that information is logically structured and easy to locate, while effective labelling provides users with clear signposts to guide their navigation. This emphasis on content accessibility aligns with the fundamental goal of scholarly publishing: to disseminate knowledge and facilitate access to information.

Following closely in importance is Readability and Clarity (C2), with a weight of 0.2269. This factor underscores the significance of presenting content in a manner that is both easy to read and comprehend. Scholarly content can often be complex and dense,

requiring careful attention to formatting and language use to enhance readability. Websites that prioritize readability ensure that text is presented in a clear and concise manner, with appropriate use of headings, paragraphs, and formatting styles to facilitate comprehension. By enhancing readability, websites can engage users more effectively, encouraging them to explore the content in greater depth and fostering a positive user experience. Thus, alongside content accessibility, readability and clarity play a crucial role in ensuring that journal websites effectively fulfil their role as platforms for scholarly dissemination.

Search Functionality (C3) holds significant importance in facilitating efficient information retrieval, despite its comparatively lower weight of 0.1072. This factor acknowledges the critical role of search features in aiding users to find relevant content swiftly and accurately. Websites equipped with robust search functionalities offer users a streamlined approach to navigate through vast repositories of information. Advanced filtering options, relevance ranking algorithms, and autocomplete suggestions enhance the search experience, enabling users to pinpoint specific articles or topics with ease. While its weight may be lower than other factors, the effectiveness of search functionality is pivotal in ensuring user satisfaction and engagement, particularly for users seeking precise and tailored information.

User-Friendly Navigation (C6) emerged as a key determinant of overall usability, closely aligned with mobile responsiveness in terms of weight (0.1059). This factor underscores the significance of intuitive navigation structures and logical pathways in guiding users through the website. Websites with user-

friendly navigation features facilitate seamless exploration and discovery of content, enhancing the overall user experience. Clear menu structures, consistent navigation elements, and well-organized content hierarchies contribute to a sense of familiarity and ease of use for users. By prioritizing user-friendly navigation, websites can effectively engage users and encourage prolonged interaction, ultimately fostering a positive perception of the platform. Thus, while its weight may be similar to mobile responsiveness, user-friendly navigation plays a pivotal role in shaping user satisfaction and usability on journal websites.

Mobile Responsiveness (C5) stands as another crucial aspect of UI design, particularly given the prevalence of mobile devices, as reflected by its weight of 0.1002. The increasing use of smartphones and tablets necessitates websites to adapt seamlessly to various screen sizes and devices. Websites that prioritize mobile responsiveness ensure a consistent and optimal user experience across platforms, regardless of the device used. By embracing responsive design principles, such as flexible layouts and scalable images, these websites cater to the diverse needs of users and contribute to a positive browsing experience.

Performance and Loading Speed (C7), though slightly less weighted at 0.0964, wield significant influence over user satisfaction and engagement. Websites those deliver fast-loading pages and smooth browsing experiences are perceived more positively by users. Optimizing performance parameters, such as server response times and page rendering speeds, enhances the overall usability of the website and encourages users to engage with its content. In today's fast-paced digital landscape, users expect instant access to information, and websites that prioritize

performance are better positioned to meet these expectations.

Visual Design (C4), with its moderate weight of 0.0679, plays a pivotal role in shaping user perceptions of journal website interfaces. Websites with visually appealing layouts, cohesive colour schemes, and well-designed graphics are generally rated more positively in terms of visual appeal. Visual design elements not only enhance the aesthetic appeal of the website but also contribute to its usability and user engagement. By incorporating principles of visual hierarchy, typography, and imagery, websites can effectively communicate their brand identity and enhance the overall user experience.

Feedback Mechanisms (C8), though assigned the lowest weight of 0.0393, remain vital for fostering user engagement and soliciting user input for continuous improvement. Websites that provide easy ways for users to submit feedback, share their experiences, or report issues demonstrate responsiveness and a commitment to user-centric design. Feedback mechanisms enable websites to gather valuable insights from users, identify areas for improvement, and drive iterative enhancements to the UI design. By actively soliciting and incorporating user feedback, websites can enhance their relevance, usability, and user satisfaction over time.

To determine the ranking of the alternatives COCOSO and MARCOS was employed. Normalized decision matrix obtained as per COCOSO approach is shown in Table 5. Weighted comparability sequence and Si value is obtained as shown in Table 6. Exponentially weighted comparability sequence and Pi values is obtained as shown in Table 7. The Final Aggregation and Ranking is obtained as shown in Table 8. The table provided contains data pertaining to different alternatives (A1, A2, A3, A4, A5)

Table 5 — COCOSO –Normalized decision matrix

Type Criteria	Max C1	Max C2	Max C3	Max C4	Max C5	Max C6	Max C7	Max C8
A1	0.538	0.417	1.000	0.833	0.500	1.000	0.857	0.600
A2	1.000	0.750	0.625	0.333	1.000	0.429	0.286	1.000
A3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A4	0.462	1.000	0.250	0.167	0.125	0.143	0.143	0.200
A5	0.615	0.333	0.750	1.000	0.375	1.000	1.000	0.600

Table 6 — Weighted comparability sequence and Si value

Criteria	C1	C2	C3	C4	C5	C6	C7	C8	Si
A1	0.138	0.095	0.107	0.057	0.050	0.106	0.083	0.024	0.658
A2	0.256	0.170	0.067	0.023	0.100	0.045	0.028	0.039	0.728
A3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A4	0.118	0.227	0.027	0.011	0.013	0.015	0.014	0.008	0.433
A5	0.158	0.076	0.080	0.068	0.038	0.106	0.096	0.024	0.645

Table 7 — Exponentially weighted comparability sequence and Pi values

Criteria	C1	C2	C3	C4	C5	C6	C7	C8	Pi
A1	0.853	0.820	1.000	0.988	0.933	1.000	0.985	0.980	7.559
A2	1.000	0.937	0.951	0.928	1.000	0.914	0.886	1.000	7.616
A3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A4	0.820	1.000	0.862	0.885	0.812	0.814	0.829	0.939	6.961
A5	0.883	0.779	0.970	1.000	0.906	1.000	1.000	0.980	7.519

Table 8 — Final Aggregation and Ranking

	K _a	Rank	K _b	Rank	K _c	Rank	K _i	Rank
A1	0.256	2	8217555	2	0.984759	2	2739313	2
A2	0.260	1	8344737	1	1	1	2781709	1
A3	0.000	5	0	5	0	5	0	5
A4	0.230	4	7393708	4	0.886033	4	2464685	4
A5	0.254	3	8163565	3	0.978289	3	2721315	3

Table 9 — Extended initial decision matrix

	C1	C2	C3	C4	C5	C6	C7	C8
AAI	3.5	3.8	4.0	4.2	4.1	4.2	4.2	4.2
A1	4.2	4.3	4.8	4.7	4.5	4.9	4.8	4.5
A2	4.8	4.7	4.5	4.4	4.9	4.5	4.4	4.7
A3	3.5	3.8	4.0	4.2	4.1	4.2	4.2	4.2
A4	4.1	5.0	4.2	4.3	4.2	4.3	4.3	4.3
A5	4.3	4.2	4.6	4.8	4.4	4.9	4.9	4.5
AI	4.8	5.0	4.8	4.8	4.9	4.9	4.9	4.7

Table 10 — Results of MARCOS method

A _i	S _i	K _i ⁻	K ⁺	f(K ⁻)	f(K ⁺)	f(K _i)	Rank
A1	0.923	1.153	0.923	0.445	0.555	0.681	2
A2	0.956	1.194	0.956	0.445	0.555	0.705	1
A3	0.800	1.000	0.800	0.445	0.555	0.590	5
A4	0.900	1.124	0.900	0.445	0.555	0.664	4
A5	0.921	1.150	0.921	0.445	0.555	0.679	3

evaluated across multiple criteria (K_a, K_b, K_c, K_i). Each alternative is assigned a weight (K_a) and is ranked accordingly based on that weight. Similarly, each criterion is associated with a numerical value and its corresponding rank among the alternatives. For example, alternative A1 holds a weight of 0.256 for criterion K_a, ranking second among the alternatives, while its numerical value for criterion K_b is 8217555, also ranking second. These rankings and weights enable a systematic comparison of the alternatives across the specified criteria, aiding in the identification of the most favourable alternatives for each criterion. The order of alternative obtained is as follows:

$$A2 > A1 > A5 > A4 > A3$$

In the second stage, alternatives were ranked using MARCOS methodology. The data in Table 9 shows the extended initial decision matrix. Results of MARCOS method is outlined in Table 10. As observed the ranking of the both the methods are matching.

Sensitivity Analysis

A sensitivity analysis was conducted to judge whether the weights of the criteria impact the ranking

of the alternatives, as noted by Puška *et al.* (2018)⁴⁴. To do so, the most significant criteria was ‘C1’ having weight of 0.2562. The weight of C1 was decreased by 5%. The weights of remaining criteria were adjusted using the Eq. 21.

$$\tilde{W}_{n\beta} = (1 - \tilde{W}_{n\alpha}) \frac{\tilde{W}_{\beta}}{(1 - \tilde{W}_n)} \dots (21)$$

where, $\tilde{W}_{n\beta}$ represents the new value of the criteria to be evaluated, $\tilde{W}_{n\alpha}$ represents the modified value of the most significant criteria, \tilde{W}_{β} represents original value of criteria to be evaluated, and \tilde{W}_n represents the original value of the most significant criteria.

The provided data in Fig. 2 represents the results of sensitivity analysis conducted across different sets (Set 1 to Set 20) for various criteria (C1 to C8). Each set presents a distinct combination of weights assigned to the criteria, allowing for an examination of how changes in these weights impact the overall outcome. For instance, in Set 1, the weights assigned to the criteria range from 0.2563 for C1 to 0.0393 for C8, while in subsequent sets, these weights vary incrementally. By systematically altering the weights

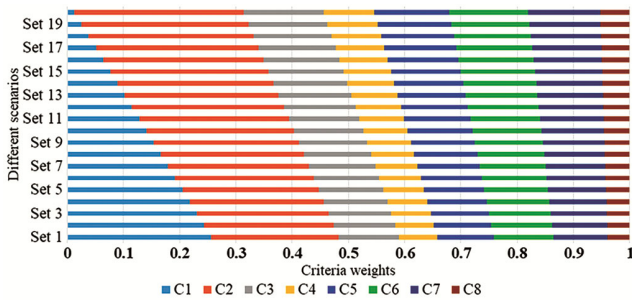


Fig. 2 — Criteria weights under 20 scenarios

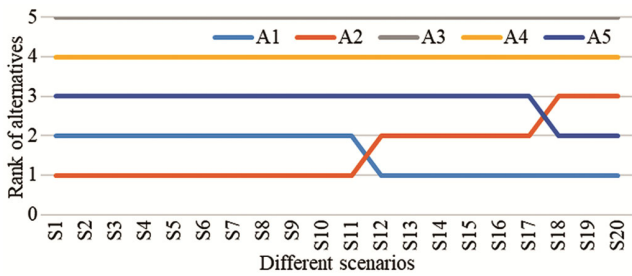


Fig. 3 — Rankings through 20 scenarios under combined compromised solution method

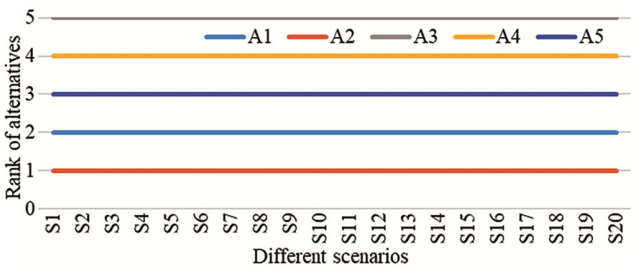


Fig. 4 — Rankings through 20 scenarios under MARCOS method

across different sets, the sensitivity analysis enables a comprehensive assessment of the robustness and reliability of the analysis findings. This approach provides valuable insights into the sensitivity of the results to changes in the assigned weights, thereby informing decision-making processes and risk assessment strategies.

The sensitivity analysis ensures the reliability of the hybrid framework. The rankings across 20 scenarios using the COCOSO method are illustrated in Fig. 3. Notably, in scenarios/set S11 and S12, there is a shift in the rankings of A1 and A2. Similarly, in scenarios S17 and S18, the rankings of A5 and A2 are altered. However, there are no changes observed in the remaining scenarios. Conversely, Fig. 4 indicates that no alterations occurred in the rankings when employing the MARCOS method.

Managerial Implication

The findings of this study hold several important managerial implications for journal website administrators and publishers. Firstly, prioritizing content accessibility and readability is crucial for enhancing user satisfaction and engagement. Ensuring that content is organized logically, labelled clearly, and presented in a reader-friendly format can significantly improve the browsing experience and encourage users to explore scholarly content further. Additionally, investing in robust search functionality and user-friendly navigation structures can streamline information retrieval processes and facilitate seamless exploration of journal websites. Furthermore, optimizing websites for mobile responsiveness and performance is essential to cater to the diverse needs of users and provide a consistent browsing experience across devices. Incorporating feedback mechanisms to solicit user input and continuously improve website usability and functionality is also recommended. By implementing these strategies, journal website managers can enhance the overall user experience, increase user engagement, and position their platforms as valuable resources for scholarly communication and dissemination.

Conclusions

In the specialized domain of journal websites, user interface (UI) design significantly influences user experience and access to scholarly content. As more publications move online, UI design becomes crucial for attracting readers and promoting engagement. Despite its importance, there's a lack of research focused on optimizing journal website UIs, unlike other digital platforms. This gap misses opportunities to enhance usability and user satisfaction. To address this, a new framework is proposed. It combines advanced decision-making techniques with entropy-based weighing to comprehensively evaluate and optimize UI designs. This methodology considers qualitative user experience aspects and quantitative usability metrics. By prioritizing criteria like content accessibility and user-friendly navigation, the framework aims to improve journal website interfaces. Future enhancements may involve integrating AR, VR, and AI, enhancing accessibility, developing adaptive designs, and implementing robust feedback mechanisms. However, challenges include technical constraints, subjective evaluation, and keeping pace with evolving technology and user needs.

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