

Evaluating UMSU Subdomain Website Inclusivity Using Preference Selection Index

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Abstract - Limited empirical evaluation of university website inclusivity can reduce equal access to academic information, especially for users with disabilities. This study evaluates the digital inclusivity of 29 Universitas Muhammadiyah Sumatera Utara (UMSU) subdomain websites using the Preference Selection Index (PSI) method. The evaluation used five criteria: Perceivability, Operability, Understandability, Robustness, and Usability. The first four criteria were derived from the Web Content Accessibility Guidelines (WCAG) principles, while Usability was added as a supporting criterion to assess practical user interaction quality. Data were collected through direct observation of each website and scored using a checklist-based rubric. The checklist scores were converted into a 1 to 5 Likert scale and then processed using PSI to calculate criterion weights and final preference values. The results show that fahum.umsu.ac.id obtained the highest score with a preference index of 1.000000, followed by fk.umsu.ac.id with 0.946643, and si.umsu.ac.id and faperta.umsu.ac.id with 0.893285. The findings indicate that PSI can reduce subjectivity in the weighting stage because the weights are generated from the decision matrix. However, the initial scoring process still depends on evaluator assessment. Therefore, the results should be interpreted as structured decision support for website improvement, not as an absolute measurement of accessibility compliance.

Keywords: Digital Inclusivity; Website Accessibility; Preference Selection Index; MCDM; Higher Education.

1. INTRODUCTION

Access to higher education is a fundamental right and an important factor in supporting social equality and sustainable development [1], [2], [3]. In the digital era, university websites have become one of the main gateways for students, lecturers, prospective students, and the public to access academic information and institutional services. These websites provide information about admission, academic programs, research activities, student services, announcements, and institutional communication. Therefore, digital inclusivity in university websites is essential to ensure that all users, including people with disabilities, can access information without barriers [4], [5], [6], [7].

Web accessibility is closely related to the principles of inclusive digital design. The Web Content Accessibility Guidelines (WCAG), developed by the World Wide Web Consortium (W3C), provide a theoretical foundation for evaluating whether digital content can be perceived, operated, understood, and interpreted reliably by different users and assistive technologies [8], [9]. These principles are relevant for higher education institutions because university websites must support users with different visual, physical, cognitive, and technological abilities. In Indonesia, the importance of inclusive access is also supported by Law No. 8 of 2016 on Persons with Disabilities and Law No. 20 of 2003 on the National Education System. These regulations emphasize equal rights in education and access to information. This aligns with Sustainable Development Goal 4, which promotes inclusive and equitable quality education for all [10], [11], [12], [13].

Previous studies have examined web accessibility and digital inclusion in various institutional contexts. Krejtz et al. [14] evaluated accessibility information practices in European universities, while Agtang [15] assessed and ranked university websites in the Philippines. Other studies also investigated accessibility challenges in academic management systems, e-government websites, public websites, and online [16], [17], [18], [19]. These studies show that accessibility problems remain common, especially in institutional websites that serve diverse users. In terms of methods, several studies have used automated accessibility evaluation, descriptive scoring, and ranking techniques. However, automated tools often detect technical issues only, while descriptive scoring may still involve subjective judgment. Multi-Criteria Decision-Making (MCDM) methods offer a more structured approach because they can evaluate several criteria at the same time [20], [21], [22].

Several MCDM methods have been used in evaluation and ranking studies, such as the Analytic Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), and Preference Selection Index (PSI). AHP is useful for determining priorities through pairwise comparisons, but it depends strongly on expert judgment. TOPSIS ranks alternatives based on their distance from ideal and negative ideal solutions, but it still requires a clear weighting process. In contrast, PSI determines criteria weights directly from the decision matrix based on data variation. This makes PSI suitable for reducing subjective bias in website

inclusivity evaluation [23]. Therefore, PSI can support a more objective ranking process when several websites must be evaluated using multiple accessibility and usability criteria.

Although previous studies have discussed website accessibility and the use of MCDM methods, several research gaps remain. First, limited studies have specifically evaluated the digital inclusivity of university sub-domain websites in Indonesia, especially at the faculty and study program level. Second, many accessibility studies still focus on general compliance or automated checking, while fewer studies integrate accessibility principles and usability criteria into an objective MCDM-based ranking model. Third, previous studies have not clearly connected WCAG-based inclusivity principles with practical institutional decision-making, especially for identifying which university websites should become improvement priorities.

This study addresses these gaps by evaluating the digital inclusivity of 29 sub-domain websites at Universitas Muhammadiyah Sumatera Utara (UMSU). Umsu was selected because its faculty and study program websites function as important access points for academic information and public communication. In this study, digital inclusivity is operationalized through five criteria: Perceivability, Operability, Understandability, Robustness, and Usability. These criteria reflect both accessibility theory and practical website quality. The criteria are then implemented in a decision matrix and processed using the PSI method to produce objective criteria weights and final preference index values.

The scientific contribution of this study is threefold. First, this study provides empirical evidence on the inclusivity level of Umsu sub-domain websites. Second, it demonstrates the use of the PSI method as an objective MCDM approach for evaluating digital inclusivity in higher education websites. Third, it offers practical ranking results that can help university managers identify priority websites for accessibility and usability improvement. The novelty of this research lies in applying PSI to evaluate university sub-domain websites by combining WCAG-related accessibility principles and usability criteria in the context of Indonesian higher education.

Therefore, this research aims to evaluate and rank the digital inclusivity of Umsu sub-domain websites using the Preference Selection Index method. The results are expected to support evidence-based improvement of university websites and provide a methodological reference for future studies on inclusive digital services in higher education.

2. RESEARCH METHODOLOGY

2.1 Research stages

To provide a clearer overview of the methodology, the research process is illustrated in a flowchart. The flowchart describes the sequence of activities from the initial identification of the problem to the final ranking and conclusion. This visualization helps explain the relationship between the theoretical framework, data collection, and the implementation of the PSI method in evaluating website inclusivity.

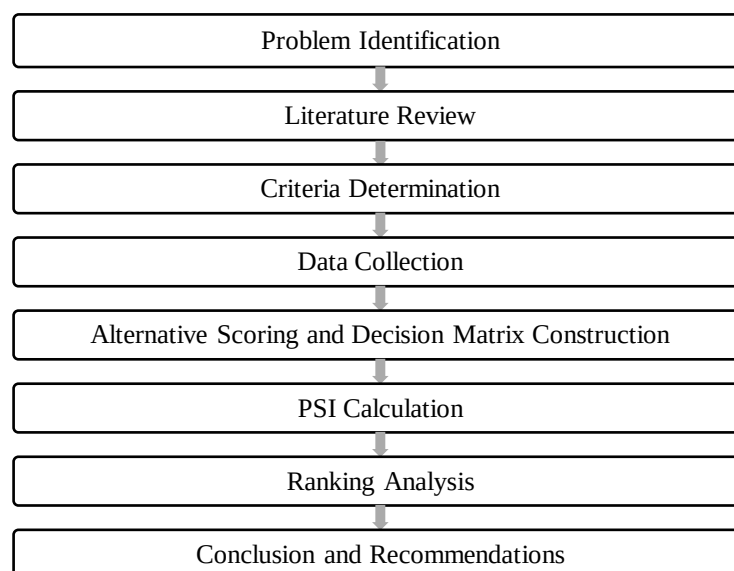


Figure 1. Research Flow of Website Inclusivity Evaluation Using the PSI Method

2.2 Data Sources and Evaluation Procedure

The data sources in this study consisted of 29 active Umsu subdomain websites representing faculties and study programs. Each website was treated as an alternative in the decision matrix. The observation focused on public

website elements that can be accessed by general users, including homepage content, navigation menu, academic information pages, news pages, contact pages, visual elements, and interface structure.

The evaluation was conducted by the research team using a checklist-based assessment rubric. The rubric was developed from WCAG-related accessibility principles and usability indicators. Each website was assessed based on five criteria: Perceivability, Operability, Understandability, Robustness, and Usability. The first four criteria were directly aligned with the WCAG principles, while Usability was included to measure practical ease of use from the user perspective. WCAG 2.2 organizes accessibility into four main principles, namely perceivable, operable, understandable, and robust, supported by testable success criteria at levels A, AA, and AAA.

Each criterion was measured using several observable indicators. Perceivability was assessed through text readability, alternative text availability, visual contrast, and clear content presentation. Operability was assessed through navigation access, keyboard interaction, focus visibility, and menu consistency. Understandability was assessed through language clarity, predictable layout, labels, and user instructions. Robustness was assessed through semantic structure, browser compatibility, responsive display, and compatibility with assistive technologies. Usability was assessed through ease of navigation, content organization, mobile responsiveness, and task efficiency.

The scoring process used a 1 to 5 Likert scale. A score of 1 indicated very poor implementation, 2 indicated poor implementation, 3 indicated moderate implementation, 4 indicated good implementation, and 5 indicated very good implementation. To improve transparency, the checklist fulfillment percentage was converted into the Likert scale as follows: 0 to 20 percent = 1, more than 20 to 40 percent = 2, more than 40 to 60 percent = 3, more than 60 to 80 percent = 4, and more than 80 to 100 percent = 5. The final score for each criterion was obtained from the average checklist result for that criterion.

2.3. Preference Selection Index Method

The Preference Selection Index (PSI) method is an objective Multi-Criteria Decision-Making (MCDM) method used to determine the most preferred alternative based on several evaluation criteria. In this study, the alternatives are 29 UMSU subdomain websites, while the evaluation criteria consist of Perceivability, Operability, Understandability, Robustness, and Usability. All criteria are treated as benefit criteria because higher scores indicate better website inclusivity performance.

The PSI method was selected because it does not require subjective pairwise comparison or prior expert-based weighting. Instead, the criterion weights are generated from the decision matrix through normalization, mean calculation, preference variation, deviation value, and final weight computation. This process allows the ranking of UMSU subdomain websites to be based on the distribution of observed scores rather than personal preference. In the context of this research, PSI is used to transform checklist-based Likert scores into final preference index values that show the relative inclusivity performance of each website.

The following are the calculation steps applying the PSI method [24], [25], [26], [27], [28], [29], [30], [31], namely:

- Determine the problem: determine the objectives and identify the attributes and alternatives involved in the decision-making problem.
- Formulate a decision matrix: this step involves constructing a matrix based on all available information that describes the attributes of the problem. Each decision matrix series is allocated to one alternative and each column to one attribute. Therefore, the X_{ij} elements of the X decision matrix assign attribute values to the original values. So, if the number of alternatives is M and the number of attributes is N then the decision matrix as an NM matrix can be represented as (1).

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

- Normalization of the decision matrix: if attribute is typebenefits then a larger value is desired which can be normalized as (2):

$$R_{ij} = \frac{x_{ij}}{x_j^{max}} \quad (2)$$

If the attribute is typecost then a smaller value is desired which can be normalized as (3).

$$R_{ij} = \frac{x_j^{min}}{x_{ij}} \quad (3)$$

Where X_{ij} is the attribute size ($i=1, 2, \dots, N$ and $j=1, 2, \dots, M$).

- Calculate value mean from normalized data: in this step, the value of the normal data for each attribute is calculated by the (4).

$$N = \frac{1}{n} \sum_{i=1}^n R_{ij} \quad (4)$$

- Calculate the value of the variation in perception: in this step, the preference variation value between the values of each attribute is calculated using the (5).

$$\phi_j = \sum_{i=1}^n [R_{ij} - N_j]^2 \quad (5)$$

- Determine the deviation in the preference value

$$\Omega_j = 1 - \phi_j \quad (6)$$

- Determines the weight of the criteria

$$W_j = \frac{\Omega_j}{\sum_{j=1}^m \Omega_j} \quad (7)$$

The total value of all the criteria for the weight of all attributes should be one, for example $\sum_{j=1}^m \Omega_j$.

- Calculate PSI: to select index preferences for each alternative, use the (8).

$$\theta_i = \sum_{j=1}^m R_{ij} W_j \quad (8)$$

- Select the appropriate alternative for the given application

2.3.1 Comparison of PSI with Other MCDM Methods

Various Multi-Criteria Decision-Making (MCDM) methods have been widely used for evaluation and ranking problems, such as AHP, TOPSIS, and PSI [23], [32], [33]. Each method has different characteristics, advantages, and limitations.

The Analytic Hierarchy Process (AHP) is commonly used because it structures decision problems hierarchically and allows pairwise comparison between criteria. However, AHP depends heavily on expert judgment in assigning weights, which may introduce subjectivity and inconsistency [32], [34], [35]. TOPSIS is another popular method that ranks alternatives based on their distance from the ideal positive and ideal negative solutions. Although effective, TOPSIS also requires predetermined criterion weights, which are often obtained through subjective judgment or other supporting methods [36], [37].

In contrast, the Preference Selection Index (PSI) method offers a more objective approach because the weights of criteria are determined mathematically from the variation of data in the decision matrix, without relying on subjective pairwise comparisons [38], [39]. This characteristic makes PSI particularly suitable for evaluating website inclusivity, where an objective and replicable assessment process is needed. In addition, PSI is relatively simple to implement and can reduce bias in decision-making compared to methods that require expert-based weighting [40], [41], [42].

Therefore, this study selected the PSI method because it is able to generate objective criterion weights, simplify the ranking process, and provide a transparent decision-making framework for assessing the inclusivity of higher education websites.

2.4. System analysis

The system analysis in this study was conducted by applying the PSI method to evaluate and rank the inclusivity of higher education websites. The analysis used sample data collected from 29 UMSU subdomain websites, which were assessed based on five criteria, namely Perceivability, Operability, Understandability, Robustness, and Usability.

These criteria were identified from the accessibility literature as essential dimensions for measuring the quality of inclusive digital platforms. Each criterion functions as a benefit attribute, meaning that a higher value indicates better website inclusivity performance.

The evaluation results for each website were converted into a Likert scale ranging from 1 to 5. These scores were then used to construct the decision matrix, which became the basis for the PSI calculation. The analysis process aimed to identify the strengths and weaknesses of each website and to determine the most inclusive website based on objective mathematical weighting.

Table 1. Website Inclusivity Evaluation Criteria

No	Criteria code	Criteria name	Type
1	C1	Perceivability	Benefit
2	C2	Operability	Benefit
3	C3	Understandability	Benefit
4	C4	Robustness	Benefit
5	C5	Usability	Benefit

The validity of the evaluation criteria was strengthened by aligning them with WCAG principles. Perceivability corresponds to the WCAG requirement that information and user interface components must be

presented in ways users can perceive. This criterion is relevant for evaluating text alternatives, contrast, readable content, and visual presentation. Operability corresponds to the requirement that user interface components and navigation must be operable. This criterion is relevant for assessing keyboard access, navigation consistency, focus visibility, and interaction control. Understandability corresponds to the requirement that information and interface operation must be understandable. This criterion is relevant for assessing clear language, predictable layout, labels, instructions, and input assistance. Robustness corresponds to the requirement that content must be robust enough to be interpreted by different user agents and assistive technologies. This criterion is relevant for assessing semantic structure, compatibility, and technical consistency.

Usability was not treated as a separate WCAG principle. Instead, it was used as a complementary criterion because accessible websites should also support effective, efficient, and comfortable interaction. In this study, Usability helped capture practical user experience aspects that may not be fully represented by technical accessibility checks alone. Therefore, the five criteria combine WCAG-based accessibility principles and practical website quality indicators.

Table 2. Converted Likert Scores of UMSU Subdomain Website Alternatives

ID	Name	C1	C2	C3	C4	C5	Average
A01	akuntansi.umsu.ac.id	3	3	3	5	3	3.4
A02	ekonomipembangunan.umsu.ac.id	3	3	3	5	3	3.4
A03	manajemen.umsu.ac.id	3	3	3	5	3	3.4
A04	manajemenperpajakan.umsu.ac.id	3	3	3	5	3	3.4
A05	ilmufalak.umsu.ac.id	3	3	3	5	3	3.4
A06	pai.umsu.ac.id	5	3	3	5	5	4.2
A07	pbs.umsu.ac.id	3	3	3	5	3	3.4
A08	piaud.umsu.ac.id	3	3	3	5	3	3.4
A09	mbs.umsu.ac.id	3	3	3	5	3	3.4
A10	si.umsu.ac.id	5	4	3	5	5	4.4
A11	ti.umsu.ac.id	4	4	3	5	4	4
A12	ds.umsu.ac.id	3	4	3	5	3	3.6
A13	teknikelektro.umsu.ac.id	4	4	3	5	4	4
A14	teknikmesin.umsu.ac.id	4	4	3	5	4	4
A15	tekniksipil.umsu.ac.id	4	4	3	5	4	4
A16	iko.umsu.ac.id	3	3	3	5	3	3.4
A17	iap.umsu.ac.id	3	3	3	5	3	3.4
A18	kesos.umsu.ac.id	3	3	3	5	3	3.4
A19	bind.umsu.ac.id	3	3	3	5	3	3.4
A20	ppg.umsu.ac.id	3	3	3	5	3	3.4
A21	bk.umsu.ac.id	3	3	3	5	3	3.4
A22	pkn.umsu.ac.id	3	3	3	5	3	3.4
A23	pendakuntansi.umsu.ac.id	3	3	3	5	3	3.4
A24	pgsd.umsu.ac.id	3	3	3	5	3	3.4
A25	pbi.umsu.ac.id	3	3	3	5	3	3.4
A26	matematika.umsu.ac.id	3	3	3	5	3	3.4
A27	fahum.umsu.ac.id	5	4	5	5	5	4.8
A28	fk.umsu.ac.id	5	4	4	5	5	4.6
A29	faperta.umsu.ac.id	5	4	3	5	5	4.4

Figure 2 presents the preliminary average inclusivity scores of 29 UMSU subdomain websites before the PSI weighting process. The horizontal axis represents the average inclusivity score on a Likert scale from 1 to 5, while the vertical axis lists the evaluated UMSU subdomain websites. The figure shows that fahum.umsu.ac.id obtained the highest preliminary average score of 4.8, followed by fk.umsu.ac.id with 4.6. The websites si.umsu.ac.id and faperta.umsu.ac.id both obtained an average score of 4.4. Most other websites obtained an average score of 3.4, indicating similar initial inclusivity performance before objective weighting was applied.

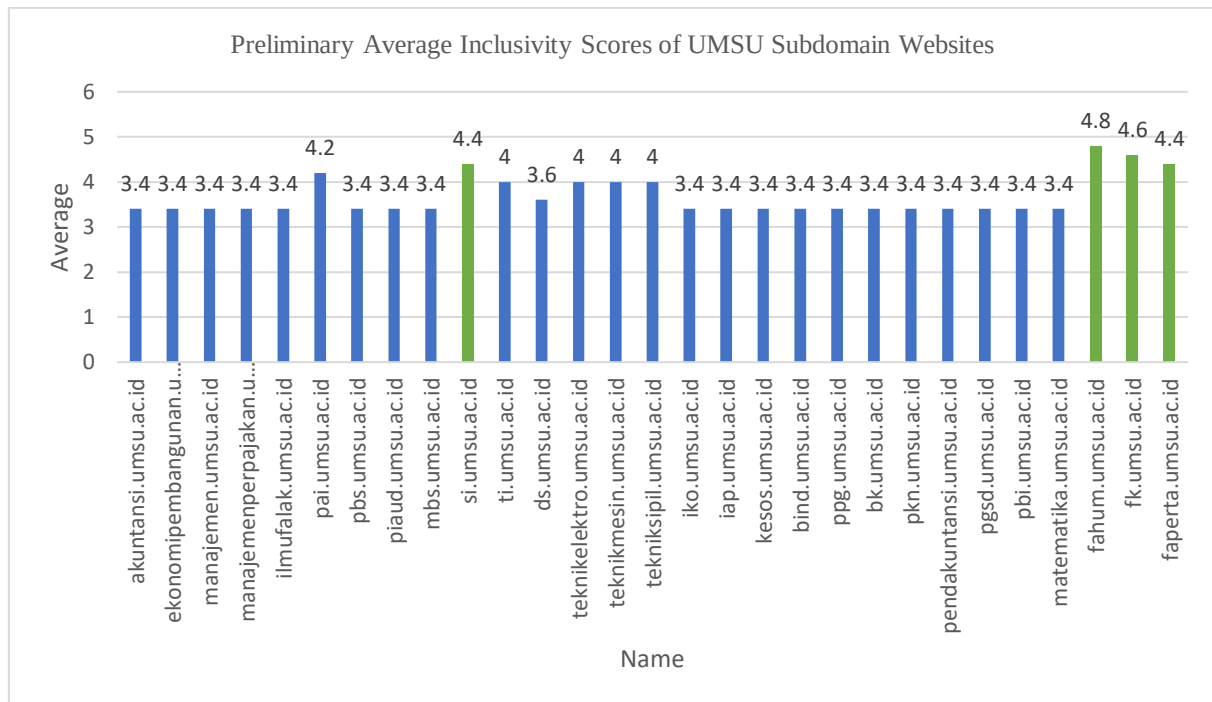


Figure 2. Preliminary Average Inclusivity Scores of UMSU Subdomain Websites (Likert Scale 1–5)

As shown in Figure 2, the preliminary average score indicates that fahum.umsu.ac.id obtained the highest average score of 4.8, followed by fk.umsu.ac.id with 4.6. Two websites, namely si.umsu.ac.id and faperta.umsu.ac.id, achieved the same average score of 4.4. This result shows that several website alternatives have similar initial performance before the PSI weighting process is applied. Therefore, the preliminary average score is useful only as an initial descriptive overview, while the final ranking is determined through the PSI method based on objective criterion weights.

Figure 2 also shows that most evaluated websites obtained an average score of 3.4. This pattern indicates that many UMSU subdomain websites have similar inclusivity performance across the five criteria. However, the average score does not fully represent the contribution of each criterion. For this reason, the PSI method is applied in the next stage to calculate criterion weights mathematically and produce a more objective final ranking.

3. RESULT AND DISCUSSION

This section presents the results of the Preference Selection Index (PSI) calculation and discusses the meaning of the obtained ranking values. The discussion is not limited to numerical calculation, but also interprets the relationship between the PSI results, the inclusivity criteria, and the research objectives. The analysis focuses on how each website alternative performs based on the five criteria, namely Perceivability, Operability, Understandability, Robustness, and Usability.

3.1. Results of the Preference Selection Index Calculation

The PSI calculation was applied to the 29×5 decision matrix constructed from the converted Likert scores in Table 2. Each row represents one UMSU subdomain website, while each column represents one inclusivity criterion: Perceivability, Operability, Understandability, Robustness, and Usability. Since all criteria are benefit attributes, higher values indicate better inclusivity performance.

After normalization, the mean normalized values for C1 to C5 were 0.696552, 0.827586, 0.620690, 1.000000, and 0.696552, respectively. The preference variation values were then calculated to determine the deviation values and criterion weights. The final weights obtained were 0.101913713 for Perceivability, 0.200996490 for Operability, 0.266787453 for Understandability, 0.328388631 for Robustness, and 0.101913713 for Usability.

These weights were then multiplied by the normalized scores of each website to obtain the final PSI preference index. The highest score was obtained by fahum.umsu.ac.id with a value of 1.000000, followed by fk.umsu.ac.id with 0.946643. The websites si.umsu.ac.id and faperta.umsu.ac.id obtained the same PSI value of 0.893285. This result shows that the PSI method can distinguish the relative inclusivity performance of websites more systematically than the preliminary average score alone.

The following are the results of applying the PSI method to the data:

- Create a decision matrix: the decision matrix based on the results of the conversion of alternative values as in (9).

$$\text{Matrix } X_{ij} = \begin{bmatrix} 3 & 3 & 3 & 5 & 3 \\ 3 & 3 & 3 & 5 & 3 \\ 3 & 3 & 3 & 5 & 3 \\ \dots & \dots & \dots & \dots & \dots \\ 5 & 4 & 3 & 5 & 5 \end{bmatrix} \quad (9)$$

- Find the maximum and minimum of each alternative: the following is a Table 3 of maximum and minimum values for each alternative.

Table 3. Maximum and Minimum Values for Each Evaluation Criterion

Maximum value	Minimum value
5	3
4	3
5	3
5	5
5	3

- Normalizing the decision matrix: in the (10)-(30) is a matrix normalization of alternative values according to type. Normalization for criterion I:

$$R_{ij} = \frac{X_{ij}}{X_{j \max}} \quad (10)$$

$$R_{11} = \frac{X_{11}}{X_{1 \max}} = \frac{3}{5} = 0.60 \quad (11)$$

$$R_{21} = \frac{X_{21}}{X_{1 \max}} = \frac{3}{5} = 0.60 \quad (12)$$

$$R_{31} = \frac{X_{31}}{X_{1 \max}} = \frac{3}{5} = 0.60 \quad (13)$$

$$R_{291} = \frac{X_{231}}{X_{1 \max}} = \frac{5}{5} = 1 \quad (14)$$

Normalization for criterion II:

$$R_{12} = \frac{X_{12}}{X_{2 \max}} = \frac{3}{4} = 0.75 \quad (15)$$

$$R_{22} = \frac{X_{22}}{X_{2 \max}} = \frac{3}{4} = 0.75 \quad (16)$$

$$R_{32} = \frac{X_{32}}{X_{2 \max}} = \frac{3}{4} = 0.75 \quad (17)$$

$$R_{232} = \frac{X_{232}}{X_{2 \max}} = \frac{4}{4} = 1 \quad (18)$$

Normalization for criterion III:

$$R_{13} = \frac{X_{13}}{X_{3 \max}} = \frac{3}{5} = 0.60 \quad (19)$$

$$R_{23} = \frac{X_{23}}{X_{3 \max}} = \frac{3}{5} = 0.60 \quad (20)$$

$$R_{33} = \frac{X_{33}}{X_{3 \max}} = \frac{3}{5} = 0.60 \quad (21)$$

$$R_{233} = \frac{X_{233}}{X_{3 \max}} = \frac{3}{5} = 0.60 \quad (22)$$

Normalization for criterion IV:

$$R_{14} = \frac{X_{14}}{X_{4 \max}} = \frac{5}{5} = 1 \quad (23)$$

$$R_{24} = \frac{X_{24}}{X_{4 \max}} = \frac{5}{5} = 1 \quad (24)$$

$$R_{34} = \frac{X_{34}}{X_{4 \max}} = \frac{5}{5} = 1 \quad (25)$$

$$R_{234} = \frac{X_{234}}{X_{4 \max}} = \frac{5}{5} = 1 \quad (26)$$

Normalization for criterion V:

$$R_{15} = \frac{X_{15}}{X_{5 \max}} = \frac{3}{5} = 0.60 \quad (27)$$

$$R_{25} = \frac{X_{25}}{X_{5 \max}} = \frac{3}{5} = 0.60 \quad (28)$$

$$R_{35} = \frac{X_{35}}{X_{5 \max}} = \frac{3}{5} = 0.60 \quad (29)$$

$$R_{235} = \frac{X_{235}}{X_{5 \max}} = \frac{5}{5} = 1 \quad (30)$$

The (31) is the overall decision matrix normalization result.

$$\text{Matrix } R_{ij} = \begin{bmatrix} 0.60 & 0.75 & 0.60 & 1 & 0.60 \\ 0.60 & 0.75 & 0.60 & 1 & 0.60 \\ 0.60 & 0.75 & 0.60 & 1 & 0.60 \\ \dots & \dots & \dots & \dots & \dots \\ 1 & 1 & 0.60 & 1 & 1 \end{bmatrix} \quad (31)$$

- Calculating the average value of the matrix: do the sum of the matrix average values of each attribute as in (32).

$$N = \frac{1}{N} \sum_{i=1}^n R_{ij} = [20.20 \ 24 \ 18 \ 29 \ 19.20] \quad (32)$$

Calculating the mean value of the results obtained above, namely:

$$N = \frac{1}{N} \sum_{i=1}^n R_{ij} = \frac{1}{29} \times 20.20 = 0.696552 \quad (33)$$

$$N = \frac{1}{N} \sum_{i=1}^n R_{ij} = \frac{1}{29} \times 24 = 0.827586 \quad (34)$$

$$N = \frac{1}{N} \sum_{i=1}^n R_{ij} = \frac{1}{29} \times 18 = 0.620690 \quad (35)$$

$$N = \frac{1}{N} \sum_{i=1}^n R_{ij} = \frac{1}{29} \times 29 = 1 \quad (36)$$

$$N = \frac{1}{N} \sum_{i=1}^n R_{ij} = \frac{1}{29} \times 19.20 = 0.662069 \quad (37)$$

- Calculating preference variation values: determine the preference variation value in relation to each criterion using the (38). Here are the preference variation values ($\emptyset_j$) as in (38).

$$\emptyset_j = \begin{bmatrix} 0.009322 & 0.006020 & 0.000428 & 0 & 0.009322 \\ 0.009322 & 0.006020 & 0.000428 & 0 & 0.009322 \\ 0.009322 & 0.006020 & 0.000428 & 0 & 0.009322 \\ \dots & \dots & \dots & \dots & \dots \\ 0.092081 & 0.029727 & 0.000428 & 0 & 0.092081 \end{bmatrix} \quad (38)$$

Then add up the results of the rank values in the preference variation matrix ($\emptyset_j$). The result of the sum of the preference variation matrices is as in (39):

$$\emptyset_j = [0.689655 \ 0.387931 \ 0.187586 \ 0 \ 0.689655] \quad (39)$$

- Defining the value of deviation in preference: here the value of deviation in preference is as in (40)-(44):

$$\Omega_j = 1 - 0.689655 = 0.310345 \quad (40)$$

$$\Omega_j = 1 - 0.387931 = 0.612069 \quad (41)$$

$$\Omega_j = 1 - 0.187586 = 0.812414 \quad (42)$$

$$\Omega_j = 1 - 0 = 1 \quad (43)$$

$$\Omega_j = 1 - 0.689655 = 0.310345 \quad (44)$$

In the (45) is the result of reducing the value in preferences consisting of:

$$\Omega_j = [0.310345 \ 0.612069 \ 0.812414 \ 1 \ 0.310345] \quad (45)$$

Calculating the total value as in (46):

$$\sum \Omega_j = 0.310345 + 0.612069 + 0.812414 + 1 + 0.310345 = 3.045172 \quad (46)$$

- Determine the weight criteria: the formula to be used in calculating the weight criteria is as in (47)-(51):

$$W_j = \frac{\Omega_j}{\sum_{j=1}^m \Omega_j} = \frac{0.310345}{3.045172} = 0.101913713 \quad (47)$$

$$W_j = \frac{\Omega_j}{\sum_{j=1}^m \Omega_j} = \frac{0.612069}{3.045172} = 0.20099649 \quad (48)$$

$$W_j = \frac{\Omega_j}{\sum_{j=1}^m \Omega_j} = \frac{0.812414}{3.045172} = 0.266787453 \quad (49)$$

$$W_j = \frac{\Omega_j}{\sum_{j=1}^m \Omega_j} = \frac{1}{3.045172} = 0.328388631 \quad (50)$$

$$W_j = \frac{\Omega_j}{\sum_{j=1}^m \Omega_j} = \frac{0.310345}{3.045172} = 0.101913713 \quad (51)$$

The results of calculating the overall value of the W_j weighting criteria are as in (52):

$$W_j = [0.101913713 \ 0.20099649 \ 0.266787453 \ 0.328388631 \ 0.101913713] = 1 \quad (52)$$

- Calculate the PSI value: to get the largest preference index value is to use the (53). The results of multiplication calculations on the $\emptyset_i$ matrix are as in (53):

$$\emptyset_i = \begin{bmatrix} 0.61148 & 0.150747 & 0.160072 & 0.328389 & 0.061148 \\ 0.101914 & 0.200996 & 0.160072 & 0.328389 & 0.101914 \\ 0.101914 & 0.200996 & 0.266787 & 0.328389 & 0.101914 \\ 0.101914 & 0.200996 & 0.213430 & 0.328389 & 0.101914 \\ \dots & \dots & \dots & \dots & \dots \\ 0.101914 & 0.200996 & 0.160072 & 0.328389 & 0.101914 \end{bmatrix} \quad (53)$$

- Select the appropriate alternative for the given application: the final step is to look for the ranking values in Table 4. To more clearly see the results of the rankings that have been achieved using the PSI can be seen in Figure 3 in the form of visualization.

Table 4. Final Ranking of UMSU Subdomain Websites Based on PSI Scores

No	ID	Name	The value of $\emptyset_i$	Decision
1	A01	akuntansi.umsu.ac.id	0.761505	Rank 11
2	A02	ekonomipembangunan.umsu.ac.id	0.761505	Rank 12
3	A03	manajemen.umsu.ac.id	0.761505	Rank 13
4	A04	manajemenperpajakan.umsu.ac.id	0.761505	Rank 14
5	A05	ilmufalak.umsu.ac.id	0.761505	Rank 15
6	A06	pai.umsu.ac.id	0.843036	Rank 9
7	A07	pbs.umsu.ac.id	0.761505	Rank 16
8	A08	piaud.umsu.ac.id	0.761505	Rank 17
9	A09	mbs.umsu.ac.id	0.761505	Rank 18
10	A10	si.umsu.ac.id	0.893285	Rank 3
11	A11	ti.umsu.ac.id	0.852520	Rank 5
12	A12	ds.umsu.ac.id	0.811754	Rank 10
13	A13	teknikelektro.umsu.ac.id	0.852520	Rank 6
14	A14	teknikmesin.umsu.ac.id	0.852520	Rank 7
15	A15	tekniksipil.umsu.ac.id	0.852520	Rank 8
16	A16	iko.umsu.ac.id	0.761505	Rank 19
17	A17	iap.umsu.ac.id	0.761505	Rank 20
18	A18	kesos.umsu.ac.id	0.761505	Rank 21
19	A19	bind.umsu.ac.id	0.761505	Rank 22
20	A20	ppg.umsu.ac.id	0.761505	Rank 23
21	A21	bk.umsu.ac.id	0.761505	Rank 24
22	A22	pkn.umsu.ac.id	0.761505	Rank 25
23	A23	pendakuntansi.umsu.ac.id	0.761505	Rank 26
24	A24	pgsd.umsu.ac.id	0.761505	Rank 27
25	A25	pbi.umsu.ac.id	0.761505	Rank 28
26	A26	matematika.umsu.ac.id	0.761505	Rank 29
27	A27	fahum.umsu.ac.id	1.000000	Rank 1
28	A28	fk.umsu.ac.id	0.946643	Rank 2
29	A29	faperta.umsu.ac.id	0.893285	Rank 4

Figure 3 visualizes the final PSI preference index scores based on the ranking results in Table 4. The horizontal axis represents the PSI preference index score from 0 to 1, while the vertical axis displays the website name and rank position. This visualization shows that fahum.umsu.ac.id ranked first with a PSI score of 1.000000, followed by fk.umsu.ac.id with 0.946643. The websites si.umsu.ac.id and faperta.umsu.ac.id obtained the same PSI score of 0.893285, indicating equal preference values based on the applied criteria and weights.

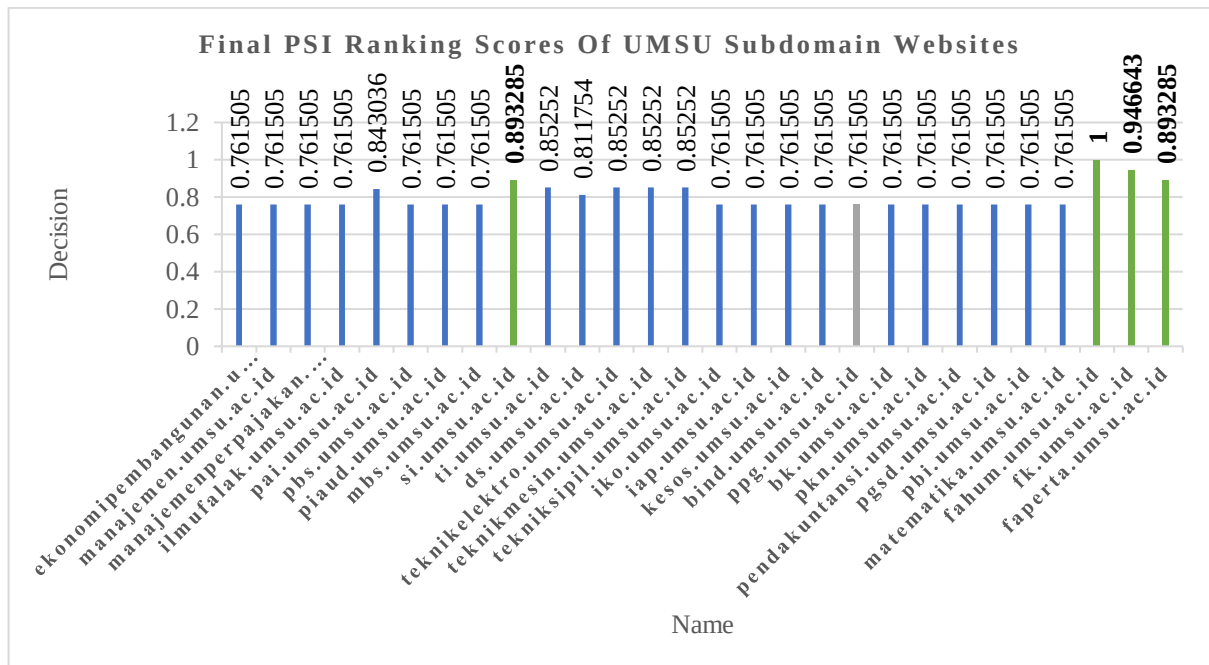


Figure 3. Final PSI Ranking Scores of UMSU Subdomain Websites

3.2 Interpretation of Ranking Results

The ranking results show that fahum.umsu.ac.id achieved the highest PSI score because it obtained strong scores in Perceivability, Understandability, Robustness, and Usability. This indicates that the website performed better in presenting readable content, organizing information clearly, maintaining technical compatibility, and supporting practical user interaction. However, its Operability score was not perfect. This suggests that improvement is still needed in navigation control, keyboard access, focus visibility, or menu interaction.

The second position was achieved by fk.umsu.ac.id. This website also showed strong inclusivity performance, especially in Perceivability, Robustness, and Usability. However, its lower score in Understandability compared with fahum.umsu.ac.id indicates that the website may still need improvement in content clarity, page structure, labels, or user instructions. This difference explains why its PSI value was lower even though its overall performance remained strong.

The third and fourth positions were occupied by si.umsu.ac.id and faperta.umsu.ac.id. Both websites obtained the same PSI score because they had similar scores across the evaluated criteria. This result should not be interpreted as a meaningful difference in inclusivity level. Without an additional tie-breaking rule, both websites can be considered to have equal performance. Their main weakness was found in Understandability, which indicates the need to improve information clarity, consistent terminology, structured headings, and guidance for users.

Most other websites obtained the same PSI score of 0.761505. This repeated score shows that many subdomain websites had similar patterns: moderate scores in Perceivability, Operability, Understandability, and Usability, but high scores in Robustness. This pattern suggests that the websites may already have basic technical structure, but still require improvements in user-facing accessibility aspects. The most relevant improvements include adding alternative text to images, improving color contrast, strengthening heading hierarchy, making navigation more consistent, ensuring keyboard accessibility, and simplifying content structure.

From a technical perspective, websites with low or moderate Perceivability scores should prioritize readable text, sufficient contrast, proper image descriptions, and clear visual hierarchy. Websites with low Operability scores should improve keyboard navigation, visible focus indicators, skip links, and consistent menu behavior. Websites with low Understandability scores should improve language clarity, page titles, form labels, instructions, and error messages. Websites with low Usability scores should improve mobile responsiveness, information architecture, search visibility, and task flow.

Therefore, the PSI results should not only be read as a ranking list. They should be used as a diagnostic tool to identify which criteria require improvement. High-ranked websites can serve as internal references, while moderate-ranked websites should become priority targets for accessibility and usability enhancement.

3.3 Comparison with Previous Studies and Other MCDM Methods

The results of this study are consistent with previous studies which state that website accessibility evaluation requires multiple criteria because inclusivity cannot be measured from a single technical indicator [18], [19]. Website inclusivity involves several dimensions, including readable content, accessible navigation, alternative

text, color contrast, and compatibility with assistive technologies. Therefore, the use of an MCDM approach is relevant because it allows different criteria to be analyzed within one decision-making framework [20], [22].

Compared with AHP, the PSI method provides a more objective weighting process because it does not require pairwise comparison from experts. AHP is useful when expert judgment is needed, but it may introduce subjectivity in determining the importance of each criterion [22], [35]. Compared with TOPSIS, PSI is also simpler because it does not require the calculation of distance from ideal positive and ideal negative solutions. TOPSIS can provide strong ranking results, but it usually still depends on predetermined weights [20], [22].

In this study, PSI was selected because the criterion weights were generated directly from the decision matrix. This makes the ranking process more transparent and data-driven. The result supports the objective of the study, which is to evaluate and rank higher education websites based on measurable inclusivity criteria rather than subjective preference.

3.4 Advantages and Limitations of the Results

The main advantage of the results obtained in this study is that the final ranking was produced through an objective mathematical process. The PSI method reduced the possibility of subjective bias because the criterion weights were calculated based on the variation of data among website alternatives. As a result, the ranking can be used as an initial evidence-based reference for improving website inclusivity at UMSU.

Another advantage is that the results provide a clear comparison among subdomain websites. The ranking helps identify websites with strong inclusivity performance and websites that require further improvement. This information can support university stakeholders in setting priorities for accessibility improvement, especially in relation to content readability, navigation, compatibility, and user-oriented design.

However, the results also have several limitations. First, the evaluation was limited to 29 UMSU subdomain websites, so the findings cannot be generalized to all higher education websites in Indonesia. Second, the scoring process used a 1 to 5 Likert scale, which may simplify complex accessibility conditions. Third, this study did not include direct usability testing with users with disabilities. Therefore, the PSI results should be interpreted as a structured technical evaluation, not as a complete representation of user experience. Future research should combine PSI with User Acceptance Testing (UAT), accessibility testing tools, and direct feedback from disabled users to produce a more comprehensive evaluation.

3.5 Relationship Between Results and Research Objectives

The results directly answer the research objective, which is to evaluate and rank the inclusivity level of UMSU subdomain websites using the PSI method. The ranking results identify fahum.umsu.ac.id as the most inclusive website based on the calculated preference index. In addition, the results show that several websites have similar scores, indicating the need for more detailed follow-up evaluation at the criterion level.

The findings also support the objective of identifying strengths and weaknesses in the university's digital platforms. Websites with high PSI scores can serve as internal references for inclusive website design, while websites with moderate scores require improvement in specific accessibility aspects. Thus, the PSI calculation does not only produce a ranking, but also provides a practical basis for developing more inclusive, accessible, and user-friendly higher education websites.

3.6 Limitations

This study has several limitations. First, the evaluation was limited to 29 UMSU subdomain websites, so the findings cannot be generalized to all higher education websites in Indonesia. Second, the scoring process used a 1 to 5 Likert scale, which simplified complex accessibility conditions into numerical values. Third, although PSI generated objective criterion weights from the decision matrix, the initial scoring still involved evaluator judgment. Fourth, this study did not include direct testing with users with disabilities. Therefore, the results should be interpreted as a structured website evaluation, not as a full WCAG compliance audit. Future studies should combine PSI with automated accessibility testing, expert review, and usability testing involving users with disabilities.

4. CONCLUSION

This study evaluated the digital inclusivity of 29 UMSU subdomain websites using the Preference Selection Index (PSI) method. The evaluation used five criteria: Perceivability, Operability, Understandability, Robustness, and Usability. The results showed that fahum.umsu.ac.id achieved the highest PSI score of 1.000000, followed by fk.umsu.ac.id with 0.946643. The websites si.umsu.ac.id and faperta.umsu.ac.id obtained the same PSI score of 0.893285. Most other websites obtained similar PSI scores, indicating that many UMSU subdomain websites had comparable inclusivity performance across the evaluated criteria. The PSI method produced a structured ranking because the criterion weights were calculated from the decision matrix. This reduced subjectivity in the weighting stage, although the initial scoring process still depended on evaluator assessment through a checklist-based Likert scale. Therefore, the findings should be understood as decision-support results for comparing website inclusivity performance, not as absolute WCAG compliance audit results.

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